ELECTRICAL WORLD

JULY 4, 1931
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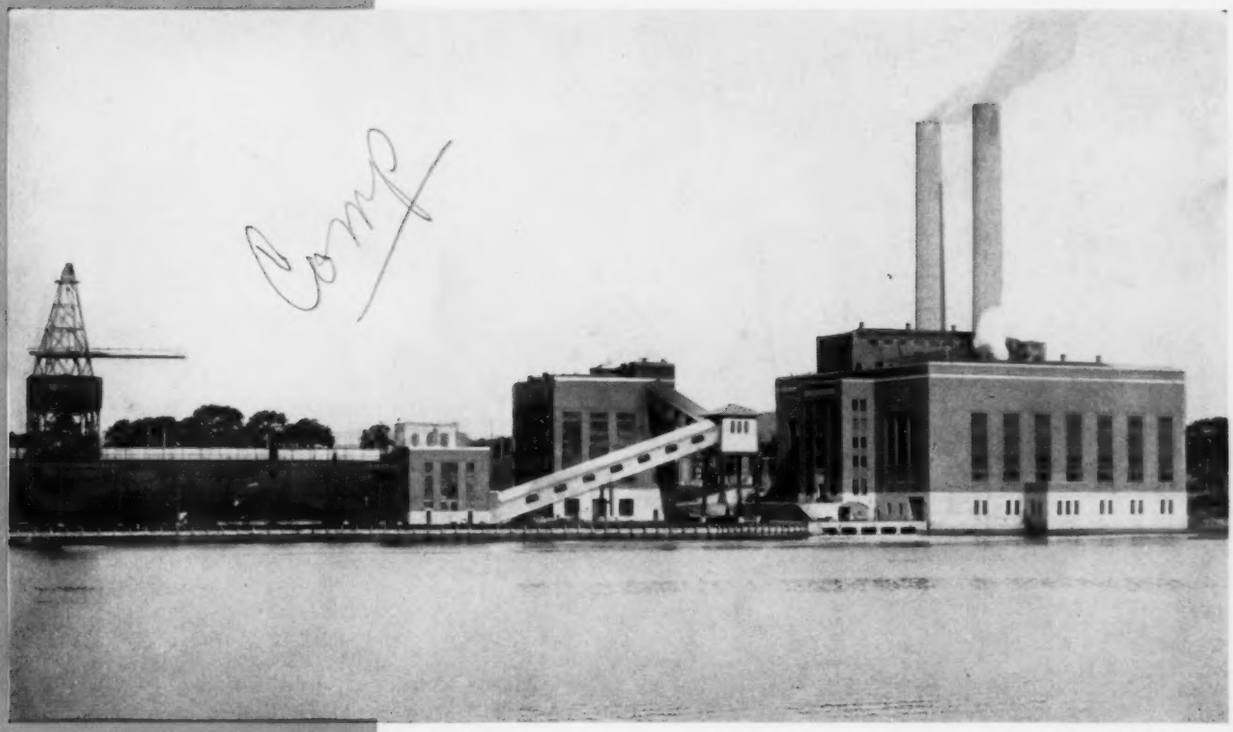

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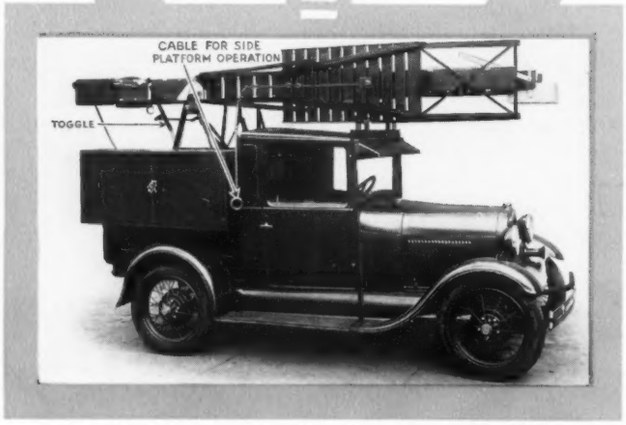

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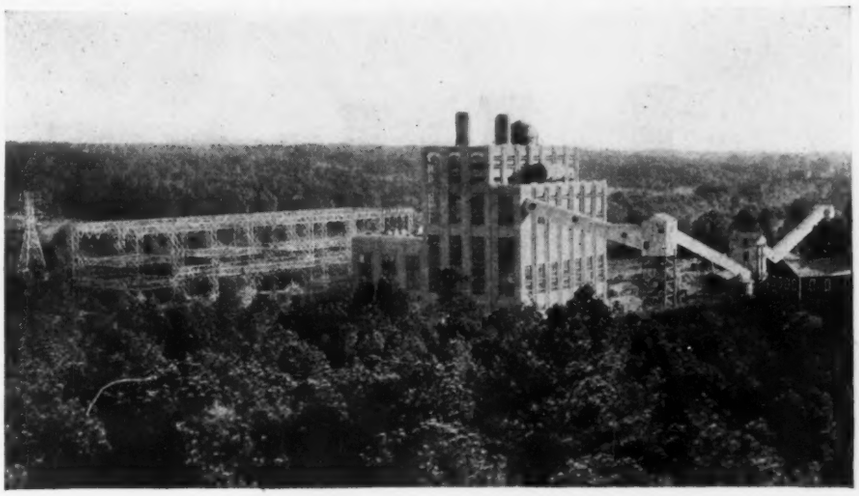

Plant Atkinson, Gorgas Power Co.

JULY 4, 1931

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ELECTRICAL WORLD

for the Week Ending

July 4, 1931

Co-operation on the part of the public is as necessary as that within our own ranks, in order to achieve and maintain the highest standards of efficiency and usefulness in the service we render. Advertising, as the liaison officer of the utilities, can do much to create an intelligent and enlightened public opinion based on a sympathetic knowledge of our mutual requirements and aims.

GEORGE B. CORTELYOU
President
Consolidated Gas Company.

—**Alabama Power Company is** winner in legislative inquiry. Committee finds utility earning less than fair return and upholds "demand charge." Public Service Commission also receives clean bill of health—*p. 4.*

—**Anti-merchandising measure** defeated in Wisconsin also as session comes to an end. Lawmaking season is over in North, but a few legislatures in the Southeast are still plugging away. Tennessee's water-power investigation brings conservative report —*p. 3.*

—**Changes in Beauharnois plans** without government sanction are admitted in Canadian parliamentary inquiry into big private St. Lawrence project—*p. 5.*

Engineers are encouraged at Asheville

—**Institute has five symposia,** devoted respectively to interconnection, power-system communication, cables, electrical units and automatic stations. Many well-posted members read papers and join in the fruitful discussions that follow—*p. 12.*

—**Able contributions to A.I.E.E.** proceedings include discourses on communication facilities as an essential part of operation, miniature supervisory control, regulation of generator voltage by tube, and reduction in cable insulation—*pp. 19, 22, 25, 27.*

Leon O. Whitsell for negotiated rates

—**Pacific Coast Association** hears member of California Railroad Commission praise informal conference between commissioners and utility executives as proper method of adjusting tariffs and obviating long and expensive contests —*p. 2.*

—**State commissions are active** despite midsummer's advent. Wisconsin's exercises new powers; Indiana's proceeds to evaluate many properties; New Hampshire's struggles with the proper disposition of issues affecting holding companies—*pp. 2, 5, 6.*

World electrical congress for Paris

—**1932 selected as proper date** for an international gathering at French capital, under auspices of the International Electrotechnical Commission, to discuss electricity in its scientific and technical relationships—*p. 4.*

—**Light and power taxation,** national, state and local, takes from the utility companies a sum in excess of one-quarter of their net revenue—*p. 36.*

—**New executives of N.E.L.A.** take office—*p. 2.*

New financing up 30 per cent over 1930

Whitsell at Del Monte Favors Negotiated Rates—Defense and Trade Relations

MORE militant action in combating the attacks upon the light and power industry is imperative, W. C. Mullendore, vice-president Southern California Edison Company, once more declared in a rousing address made at the meeting of the Pacific Coast Electrical Association last week at Del Monte, Calif., along the lines of his Atlantic City speech at the national convention.

President J. F. Owens of the national body said that temporizing with trade relations had endured too long. "There is no reason why any central station should get out of the merchandising business, since it renders a useful service in telling the public how they can use electrical appliances to their own advantage," he asserted. "It is a job that has to be done, and it will not be adequately done unless the central station stays in the business." Dealer relations he considered a job for top executives.

The most obvious improvement that can be made in present systems of regulation is by informal conference rather than formal proceeding, Leon O. Whitsell, member of the California Railroad Commission, asserted in an address of special import. Utilities can do much to improve the situation by voluntary action. If they will come before the commission in informal conference, costly legal contests and much of the bitter feeling engendered by rate controversies will be done away with. In California regulation by informal conference has proved highly successful and utilities are gradually becoming self-regulating. Three millions in rate reductions have been granted in three years by this method. One of the largest utilities of the state has not had a formal rate case brought against it in ten years.

The remarks of Paul S. Clapp, C. E. Greenwood and others were to the point and well received. A noteworthy feature of the general sessions was a suggested type of radio broadcast program presented in serial form at each session by W. A. Cyr, *Electrical West*, as a "follow-up" to some of the ideas expressed by Mr. Mullendore in his address.

All the association sections presented excellent programs. In the commercial session one well-received suggestion was made by G. C. Tenney, editor *Electrical West*, that the industry might well establish a utilization research laboratory to study into ways of developing new markets. He pointed to the potentialities in the oil industry and to the practicability of reclaiming chemically pure water from sewage by electrical treatment.

Attendance reached 390. New officers elected were: President, Addison B. Day, Los Angeles Gas & Electric Corporation; first vice-president, R. E. Fisher, Pacific Gas & Electric Company; second vice-president, W. C. Mullendore, Southern California Edison Company.

▼

New N.E.L.A. Executives Take Up Their Duties

WITH THE OPENING of the new administrative year of the National Electric Light Association on Wednesday of this week, under the presidency of J. F. Owens, the names of the new executive officers were formally announced. As previously reported in the ELECTRICAL WORLD, Harry Reid, president National Electric Power Company, becomes the fourth vice-president, Marshall E. Sampsell, Edwin Gruhl and Paul M. Downing moving up in the usual way in accordance with their respective dates of election.

The selection of A. H. Kehoe, United Electric Light & Power Company, New York, as chairman of the Engineering National Section, in succession to Alex D. Bailey, has also been previously noted. The other new section heads are J. H. Lobban, Detroit Edison Company, succeeding Franklyn Heydecke as chairman of the Accounting Section, and D. C. Green, Electric Bond & Share Company, succeeding Harry Reid as head of the Public Relations Section. T. O. Kennedy, Ohio Public Service Company, will again head the Commercial Section. Edward Reynolds, Jr., Columbia Gas & Electric Association, becomes treasurer in place of P. S. Young. Chairmen for national committees are being selected.

▼

Commission to Evaluate South Indiana Properties

ENGINEERS OF THE Indiana Public Service Commission began, on June 26, a valuation of the properties of the Public Service Company of Indiana in the southern part of the state, where this company serves more than 20 cities. The Public Service Company of Indiana is asking authority to merge with the Indiana Electric Corporation, which operates in the same territory.

Bloomington, West Baden, Columbus and French Lick are seeking rate reductions from the Public Service company, and Bedford, New Albany and Shelbyville are planning similar petitions. As before reported, in connection with the Bloomington case, the utility recently filed a cross-petition in which it asked the commission to make an appraisal of all its property in the south system, contending that it would be impossible to determine an adequate rate for Bloomington alone because of the interlocking nature of its business.

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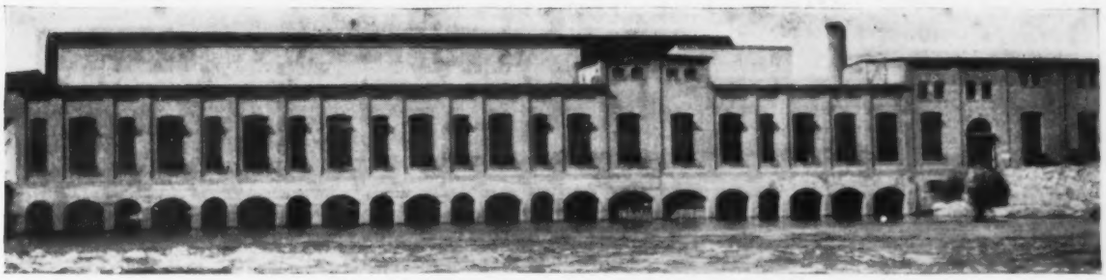
SS. "PRESIDENT HOOVER" LATEST ELECTRIC-DRIVE SHIP

On her recent trials off the coast of Maine this new "turbine electric" Dollar liner exceeded the required speed of the specifications. Eskil Berg, General Electric engineer, is on the bridge, third from the left, the pilot and two representatives of the Newport News Shipbuilding & Dry Dock Company completing the group.

MANITOBA HYDRO PLANT CELEBRATES QUARTER CENTURY OF USEFULNESS



Built by Hugh L. Cooper in 1906, the Pinawa plant of the Winnipeg Electric Company, on the Winnipeg River, with an initial rating of 16,000 hp. (since doubled), was opposed as being larger than Winnipeg would ever need! The company, which on June 9 staged a celebration of the plant's twenty-fifth anniversary, now has 168,000 hp. at Great Falls, with 225,000 hp. under way at Seven Sisters.

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Power and Regulation in State Legislatures

WITH THE ADJOURNMENT of the Illinois and Wisconsin Legislatures, interest in public utility legislation shifts to the South. Georgia's Legislature has just met in regular session, and Alabama's will not adjourn until August 1.

ALABAMA.—Governor Miller has signed a bill extending for four years the present license tax of 4 mills on each dollar of gross receipts of electric utility companies in Alabama. This was the first revenue measure passed by the Legislature. An amendment was voted down which would have limited the profit of public utilities to 6 per cent annually of the rate-making value of their property, all additional income over that figure to revert to the state as a privilege tax. Progress of utility legislation includes the passage by the Senate of a bill to permit private enterprises, principally mining concerns, to sell products usually distributed by public utilities. Power companies objected that this bill would permit mining companies to compete in the distribution of electricity while escaping utility taxation. After a bitter fight the resolution creating a commission to confer with a similar body from Tennessee regarding the solution of the Muscle Shoals problem along the lines suggested by President Hoover has passed. The Governor is expected to sign it.

COLORADO.—The utility district bill mentioned in the ELECTRICAL WORLD for February 14 (page 303) died in the rules committee of the House. This bill was to authorize county commissioners, on petition of 10 per cent of the voters in any community, to submit at a general election proposals to set up a "public utility district" in the nature of a municipal corporation controlled by a three-man commission and elected for three years.

GEORGIA.—A bill to abolish the Georgia Public Service Commission, drawn by William M. Lester, representative of Richmond County and secretary of the Georgia Municipal Utilities Rate Association, will come before the Legislature at its regular biennial session, which began on June 24. The measure would substitute for this body one to be known as the Georgia Commerce and Utility Commission and would provide for the regulation of utilities by defining their duties and powers. The new commission would be composed of three commissioners to be elected by the Legislature for a term of two years. With this commission it is proposed to have the Governor appoint a board of five members who would represent the people in all utility matters.

ILLINOIS.—The Snell bill permitting city officials to set up separate funds for proceeds from municipally owned public utilities and to invest any surplus (ELECTRICAL WORLD, June 20, page 1160) was tabled in the House upon motion of its sponsor, the night before the Legislature adjourned, because of the amendments inserted by the Senate, which, it was contended, virtually placed municipal plants under control of the Illinois Commerce Commission. The bill adopted by the House prohibiting mayors or city commissioners from being officials of any public service corporation passed the Senate also. Governor Emmerson had ten days in which to sign or veto it.

OHIO.—The General Assembly has defeated a bill which asked for an increase in the public utility corporation excise tax. Much bitterness was manifested during the debate.

SOUTH CAROLINA.—Before adjournment the Legislature appropriated $50,000 to be used by a committee of not more than five, to be appointed by the Governor, for the investigation of electric rates. This committee is to determine whether or not the power companies are receiving more than a fair return upon their investment. It will have wide powers of investigation, but all persons or corporations interested must have an opportunity to be heard. As soon as practicable it shall report its findings to the Railroad Commission of the state for the latter's guidance in fixing electric rates. A report to the Governor and Assembly must be made by January, 1932.

TENNESSEE.—The recess committee on water-power resources of the state has filed its report, of which the gist is thus summed up in the document itself: "We do not recommend that the state go into the business of producing and selling hydro-electric power to consumers generally, but that the state should preserve its rights and by adequate laws keep full regulatory control over all public utilities and private corporations engaged in the hydro-electric business." Contending that small consumers of electricity "are paying from five to ten times as much as the original cost of production and that the cost of distribution cannot justify the difference," the committee none the less advocates "that a severance tax be imposed and collected by the state of not less than 0.25 mill per kilowatt-hour of electrical power generated by hydro-electric development within the borders of the state." It further recommends hydro-electric licenses for a term not exceeding 50 years, with renewal for not more than 25 years or purchase on expiration by the state at a figure determined by prudent investment. The committee complains that "merchandising and supplies confuse the cost of production and distribution to a point where it is impossible to determine accurately for rate purposes."

TEXAS.—Governor Sterling has approved the bill passed by the regular session which permits incorporated municipalities of 500 population or more to regulate the rates of gas, light, water

and telephone companies. The bill also provides that such rates shall be referred to a vote of the people by city councils upon petition.

WISCONSIN.—The Legislature adjourned at midnight June 27. A special session will be called in the fall. Governor La Follette has signed the Loomis state utility corporation bill (ELECTRICAL WORLD, April 11, page 665, and May 23, page 936). The anti-merchandising bill aimed at utility companies was killed in the Assembly by 48 to 32. The Groves bill taxing Wiscosin utilities at regional rather than the average state rate was killed in the Senate. The Kellman bill forbidding service charges passed the Assembly but failed in the Senate.

▼

World Electric Congress for Paris Next Year

UNDER THE AUSPICES of the International Electrotechnical Commission, four French associations—the French Society of Electricians, the French Society of Physics, the French Electrotechnical Committee and the Union of Electrical Syndicates—have united to organize an International Electrical Congress to be held in Paris next year, probably in July, to discuss electricity in its scientific and technical relationships. In making this announcement Paul Janet, president of the organization committee, who is a member of the French Institute, reminds electrical engineers that it is just fifty years since the first international electricity congress was held in Paris and alludes to the more important ones since held—in Chicago in 1893, Paris in 1900 and St. Louis in 1904. He calls it "the opportune moment to sum up the work of half a century, to make a synthesis of it and submit it to a general survey." The congress will be divided into thirteen sections, as follows:

1. Science of electricity and of magnetism: General theories; insulators, conductors, radioactivity, magnetic bodies.
2. Electrical measurements: (a) Units and standards; absolute electric measurements. (b) Laboratory measurements, industrial measurements and machinery tests.
3. Production and transformation of electrical energy.
4. Transmission and distribution of electrical energy.
5. Electric traction; mechanical applications.
6. Electric lighting; photometry.
7. Electrochemistry, electrometallurgy, cells and storage batteries.
8. Communication by wire.
9. Radioelectricity; high-frequency phenomena; radio communication.
10. Radiology; electrophysics.
11. Atmospheric electricity; terrestrial magnetism.
12. Miscellaneous applications of electricity.
13. Records and history of electricity.

Legislators Absolve the Alabama Power Company

THAT THE Alabama Power Company is now paying 11 cents out of each dollar for taxes and is consequently bearing more than its proportionate share, with the result that it is not earning a fair return on the reasonable value of its property, is asserted in the final report of the Alabama legislative committee to investigate power company rates and valuations. Only one of the five members of the committee dissented. The finding was in direct contradiction of charges by certain newspapers and politicians. In discussing the "demand charge," which was the subject of some discussion before the committee, the majority report said: "We find that whatever complaint or criticism there may be of this charge is largely due to a lack of information or understanding by those making the complaint, or from those seeking to help themselves by demagogic appeals to prejudice."

The report also upholds the Public Service Commission, saying: "We think that under the administration of the present commission the utility companies are being regulated in the public interest and that it is highly conducive to the best interests of the public as well as the utilities themselves."

Much of the time of the committee was spent in a comparison of the difference between the rate-making and the tax-paying valuations of the utility companies. In this connection the majority report said that it is a "well-settled principle of law that valuation for taxation and valuation for rate-making purposes are two entirely separate and distinct things."

▼

M. J. Insull Replies to Political Accusations

STATEMENTS OF Governor Pinchot of Pennsylvania, Senator Norris of Nebraska and other antagonists of the electric power industry were labeled "fictions" by Martin J. Insull of Chicago, president of the Middle West Utilities Company, in an address before the Inter-Club Council at Pittsburgh last week, which was interpreted in some quarters as the opening gun in a utility campaign to refute political accusations.

Mr. Insull cited contentions ascribed to Governor Pinchot and Senator Norris that users of electricity are being overcharged from $500,000,000 to $750,000,000 annually. "Since electricity is sold to industrial users in competition with other forms of power, this overcharge would have to be made upon the household customers," Mr. Insull said. "As the total bill of household customers for the entire country is only $650,000,000 annually, the industry would have to provide electricity free and even give the customers $100,000,000 besides if there is anything in such claims of overcharging.

"The fact is that the $12,000,000,000 invested in the industry is earning a net income of a little over 7 per cent, which is a necessary return if the industry is to continue to be capable of raising capital with which to extend service."

Mr. Insull dwelt in detail on the expense items of the utilities to demonstrate that neither excessive return nor extravagant operation can be charged to them.

"In the confusion of present-day conditions there is danger of forsaking some of the fundamental principles of American progress," Mr. Insull asserted, and he emphasized the necessity of upholding the principles of individual initiative and enterprise in the face of efforts to abandon them by encouraging governmental invasion of the business field.

Brief History of the "Electrical World"

The *Electrical World* (published under that name since 1883 and tracing its history back to 1874) is a consolidation of the *Electrical Engineer* (founded in 1882 as the *Electrician*) and the *American Electrician* (founded in 1896). Final consolidation under the title of *Electrical World* took effect on January 1, 1906, the *Electrical World* and the *Electrical Engineer* having been acquired by the McGraw Publishing Company in 1899 and amalgamated as the *Electrical World and Engineer*, and the *American Electrician*, a McGraw monthly, having been absorbed seven years later.

The roster of past editors of the *Electrical World* includes Carl Hering, Louis Bell, W. D. Weaver, T. C. Martin and many other men prominent in the electrical industry—some, like those named, no longer living, and others, like W. H. Onken, Jr., C. O. Mailloux, A. S. McAllister, Frank F. Fowle, F. M. Feiker, D. H. Braymer and H. V. Bozell, still active in engineering and industrial service. L. W. W. Morrow is now editor. Allen M. Perry is managing editor. Other members of the present staff are: Earl Whitehorne, contributing editor; G. F. Wittig, statistical editor; H. M. Cameron and A. E. Knowlton, associate editors; F. C. Wells, news editor; E. R. Searles and E. M. Glennon, assistant editors; F. R. Innes, Western editor; H. S. Knowlton, New England editor; Walter C. Heston, Pacific Coast editor, and Paul Wooton, Washington correspondent.

AUSTRIAN PARLIAMENT BUILDING ILLUMINATED FOR VIENNA FESTIVAL

For this festival, which began about the middle of June, 54 kw. was used in floodlighting this beautiful edifice. In the background the illuminated tower of the Vienna Town House is to be seen.

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Trade Commission Adds to Its Publicity Records

REVERTING TO THE publicity phase of its utility investigation, the Federal Trade Commission on June 25, at its last hearing until after Labor Day, put into its records pamphlets, textbooks and other electrical literature pertinent to the inquiry, at the instance of W. T. Chantland, assistant chief counsel of the commission. There were no witnesses, and the data submitted were largely in the nature of a summary of matters previously canvassed.

Mr. Chantland submitted copies of pamphlets issued by the power companies which were said to have been sent into nearly every state and into thousands of schools and colleges in 1926, 1927 and 1928, the total number distributed in that period being put at 880,000, of which 136,000 went to Ohio, 125,000 to Illinois, 114,000 to New York, 60,000 to Pennsylvania, 64,000 to Iowa and 165,000 to New England.

Other items filed included N.E.L.A. rate books, statistics from the Bonbright Survey and articles from the ELECTRICAL WORLD.

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New Hampshire Case Brings Series of Orders

IN A REPORT of 27,000 words the New Hampshire Public Service Commission has just ordered the New Hampshire Gas & Electric Company of Portsmouth and the Derry Electric Company to show cause on or before September 10 why a series of eleven orders based on the commission's investigation of these utilities should not become effective. The report found that "from a practical standpoint the two companies are controlled and operated by the Associated Gas & Electric Company." The commission held that "these holding companies may retard lower production cost" and that the danger in this "is postponement of rate reductions" on the side of the public and "to the utilities the likelihood of municipal ownership."

▼

Midland United Buys Terre Haute Company

PROPERTIES OF THE Terre Haute, Indianapolis & Eastern Traction Company in Indiana operating power and interurban utilities have been sold to the Midland United Company, owned by Insull interests, for $2,500,000. Following years of diminishing profits, then increasing losses, the courts ordered the sale on behalf of the receiver appointed in April, 1930. The sale price was the minimum fixed by the court. The Insull company already had heavy stock holdings in the company sold, which was a main factor in the abortive "seventy-million-dollar" Indiana merger proceedings last year.

More recently the Midland United Company purchased a majority of the company's bonds on approval of the bondholders' protective committees. Ownership of these bonds gave the Midland firm control of the common stock of the Terre Haute Traction & Light Company, providing light and power to Terre Haute and one of the paying subsidiaries of the company.

▼

Changes in Original Plans for Beauharnois Admitted

OUTSTANDING FEATURES of the first week of the hearings by the special parliamentary committee investigating the charges leveled against the Beauharnois Power Corporation in the Canadian House of Commons were the frank admission of the Beauharnois corporation's counsel that the company's detailed plans have never received the approval of the federal government; a statement by D. W. McLachlan, chairman of the Canadian section of the International Joint Board of Engineers, to the effect that the intake of the Beauharnois canal had been moved 3,000 ft. from the location shown on the original plans without sanction from the Dominion government, any department of the government or its engineers; submissions by Peter White, chief counsel for the special committee, purporting to show a spread of $3,000,000 which went to the underwriters in connection with the Beauharnois corporation's bond issue of $30,000,000, and a statement by Aimé Geoffrion, counsel for the Beauharnois corporation, in a letter to Charles Dunning, former federal Minister of Railways, accusing of falsehood the Atlantic & Great Lakes Company, which is suing the Beauharnois corporation for $10,000,000 because of an unexercised option from the origi-

THE ALL-ELECTRIC ORGAN MAKES ITS ENTRY

Photo by Halbran

Sans pipes, sans blower and sans everything formerly organic except the familiar keyboard, the organ has been wholly reformed. This one, the invention of Richard Ranger, engineer and musician, relies upon vacuum tubes, loud speakers, relays and amplifiers.

▼ ▼ ▼

nal owners of the Beauharnois property.

The line of argument taken by counsel for the corporation was that anything the company has so far built at Beauharnois does not interfere with navigable water and that therefore government consent to changes was not necessary. However, it was agreed that the government would have to approve of the plans ultimately before the canal could be used.

▼

Wisconsin Commission, with New Powers, Busy

ACTING UNDER POWER granted by the 1931 Legislature, the Wisconsin Public Service Commission has issued a general order requiring all public utilities to make a full report on their ownership and affiliated interests by August 15. The specific information that is sought includes the names of persons or corporations owning or holding 1 per cent or more of the voting securities of every Wisconsin public utility corporation or 5 per cent of the voting securities of any corporation in a chain of successive ownership with a Wisconsin corporation. Names of the corporations in which 5 per cent or more of the voting securities is owned by a person or corporation holding 5 per cent or more of a Wisconsin utility's voting securities are also demanded, together with names of all officers and directors of Wisconsin utilities and names of all corporations or associations having one or more officers or directors in common with them.

Announcement of an investigation of the Wisconsin Power & Light Company throughout the state has been made by the commission. The inquiry will concern rates, service, policies, records, securities, accounts, financial conditions, transactions and practices of the company, which is a Byllesby subsidiary. Under the new law the cost of such an inquiry can be assessed against the corporation. The commission, in its order, states that a number of complaints have been filed respecting the rates and practices of the company. "These complaints have come from municipalities and groups of subscribers in communities large and small," says the order, "including such cities as Fond du Lac, Janesville, Clinton, Beloit and Sheboygan, and from rural consumers. We are consolidating all the complaints into this single proceeding."

The Public Service Commission has announced the appointment of two widely known public utility experts as members of its staff—John M. Bickley and Samuel Miesels. Mr. Bickley is now in charge of the accounting and finance department of the commission. Mr. Miesels will assist him. Mr. Bickley comes to the commission from the Federal Trade Commission. Mr. Miesels has been with both the Federal Trade and the Federal Power Commission.

Scattered Happenings in the Electrical Sphere

UNITED STATES

Brooklyn Edison Starts Extra Work

M. S. Sloan said recently that an appropriation of $5,000,000 to carry on the Brooklyn Edison Company's program of placing its overhead lines underground had just been approved by the board of directors. "This appropriation," said Mr. Sloan, "is in addition to our regular budget for 1931. It provides for work we did not contemplate doing this year. The directors authorized it in order to keep on our pay rolls 1,500 construction workers whom we should have had to lay off in about a month because the jobs authorized would be completed and the money for such work exhausted."

White Addresses Agricultural Engineers

A permanent "farm-mindedness" governed by scientific achievement is under way in this country and may prove the most significant agricultural development of the time, Dr. E. A. White of Chicago declared in his address last week at the twenty-fifth annual meeting of the American Society of Agricultural Engineers at Iowa State College. "Within the next decade," he said, "we may expect to be able to talk of there being three million farms with electric service. The increasing comfort and convenience of farm life will lead to a changed outlook upon rural living. More people will retire to the country."

Transfer of Rock Island License

The Federal Power Commission has approved the transfer of the 210,000-hp. license for the Rock Island water-power project in the Columbia River near Wenatchee, Wash., from the Washington Electric Company to the Puget Sound Power & Light Company, the parent organization.

Kansas Commission Predicts Lower Rates

Further reductions in domestic rates for electricity in Kansas are predicted by the Public Service Commission as the result of its efforts, based largely on the lower price of coal, fuel oil, copper and other things entering into energy production. Some members of the commission also desire to work for the ultimate abolition of meter charges, customers' deposits and minimum bills.

Union Carbide Adds Steam Equipment

Four 25,000-hp. boilers are now being installed at Alloy, W. Va., by the Union Carbide Company to generate supplementary power to that produced by the water turbines at the mouth of the Hawk's Nest tunnel. The first two boilers will be completed by September 1. When the water-power and steam projects under construction

are completed the company will have a total of 210,000 hp.

To Enlarge Shreveport Power Station

To meet the growing demands for power in the new east Texas oil field, as well as an increased general demand in Texas, Louisiana and Arkansas, the Central & South West Utilities Company says that an 18,750-kw. power unit will be added to the Arsenal Hill generating station at Shreveport, La. The new unit will increase the Shreveport station's capacity to 56,250 kw.

Tennessee Official Accused as Utility Man

Impeachment of Ernest N. Haston, Secretary of State of Tennessee, was asked in articles filed last week in the House of Representatives but afterward withdrawn. Charge was made that he is an attorney of the Tennessee Electric Power Company and has been during his official term of service and that his failure to act as a member of the State Board of Equalization when matters of this company were under discussion was a violation of his oath of office.

Colorado Springs to Serve Pike's Peak

Territory served by Colorado Springs' municipally owned lighting plant will be enlarged by permission of the Colorado Public Utilities Commission. The transmission line between Manitou and Cascade will be extended from Cascade to Green Mountain Falls and the north slope of Pike's Peak. The city recently acquired the generating and distribution plant, as well as the land, on Pike's Peak from the Empire Water & Power Company.

Arkwright on Atlanta Agitation

Speaking at Cedartown, Ga., P. S. Arkwright, president Georgia Power Company, declared that the recent agitation in Atlanta over proposed municipal ownership of utilities was the outgrowth of a strike and had no general public demand back of it.

Rogue River Applications Canceled

Cancellation of six water applications involving the proposed development of 310,000 hp. has been ordered by the Oregon Hydro-Electric Commission. The applications were filed by Charles H. Lee and Romaine W. Myers of Oakland, Cal., who asked for authority to appropriate a total of 18,250 sec.-ft. of water from the Rogue River. The commission canceled the applications on the ground that the Legislature of 1929 forbade the construction of dams in the main channel of the Rogue River for a distance of 100 miles from the Pacific Ocean.

Taxing Receipts on Imported Energy

Attorney-General Bettman of Ohio is quoted as maintaining that the recent decision of United States Supreme Court upholding a tax on total receipts from natural gas sold and distributed in Ohio although part of it was manufactured in another state applies also to electric utilities and as declaring that litigation will be commenced against these utilities if they take the stand that they are not affected by the East Ohio Gas Company decision. His view has been accepted by counsel for the Ohio Power Company, which is expected to pay $409,674 in back taxes.

Valuation for San Diego Consolidated

Members of the San Diego (Calif.) City Council have been promised the co-operation of the State Railroad Commission in the investigation of the rates and practices of the San Diego Consolidated Gas & Electric Company. This will take the form of an independent survey of the properties but probably not a complete revaluation.

Cushing Cancels Bonds for Plant

City commissioners of Cushing, Okla., have canceled $215,000 of the bond issue for $300,000 voted December 2 last for the establishment of an electric light and power plant. The city instead has made a contract with the Oklahoma Gas & Electric Company to furnish energy for a municipally owned distribution system.

San Francisco Dissatisfied with Rates

Two resolutions have been adopted by the Board of Supervisors of San Francisco with the object of having the city appear before the California Railroad Commission to seek lower lighting rates for streets and public institutions. These resolutions followed the bid of the Pacific Gas & Electric Company. The power company explained that lower rates cannot be made for the coming year on account of the water shortage.

Coming Meetings

Camp Co-operation XI — Association Island, Henderson Harbor, N. Y., July 27-31. Society for Electrical Development, 420 Lexington Ave., New York.

American Institute of Electrical Engineers—Pacific Coast Division, Lake Tahoe, Calif., Aug. 25-28. F. L. Hutchinson, 33 W. 39th St., New York.

Rocky Mountain Division, N.E.L.A. —Stanley Hotel, Estes Park, Colo., Sept. 2-4. G. E. Lewis, 367 Gas & Electric Bldg., Denver.

Electrochemical Society — Hotel Utah, Salt Lake City, Sept. 2-5. C. G. Fink, Columbia University, New York.

Pennsylvania Electric Association — Bedford Springs Hotel, Bedford Springs, Pa., Sept. 9-11. H. A. Buch, Telegraph Bldg., Harrisburg, Pa.

Empire State Gas and Electric Association—The Sagamore, Bolton Landing, Lake George, N. Y., Sept. 10-11. C. H. B. Chapin, Grand Central Terminal, New York.

American Welding Society — Copley-Plaza Hotel, Boston, Sept. 21-25. M. M. Kelly, 33 W. 39th St., New York.

New England Division, N.E.L.A.— Poland Springs House, South Poland, Me., Sept. 28-30. Miss O. A. Bursiel, 20 Providence St., Boston.

Great Lakes Division, N.E.L.A.— French Lick Springs Hotel, French Lick, Ind., Oct. 1-3. T. C. Polk, 20 N. Wacker Drive, Chicago.

Illuminating Engineering Society—William Penn Hotel, Pittsburgh, Oct. 13-16. E. H. Hobbie, 29 W. 39th St., New York.

CANADA

New Cape Breton Company Formed

Following upon the public sale of the assets of the Cape Breton Electric Company (ELECTRICAL WORLD, May 16, page 895), the Eastern Light & Power Company has been formed to take over and operate the distribution system and power plant. Willard S. Thompson, North Sydney, Nova Scotia, is president of the board.

Quebec's Electric Rates Attacked

Addressing a gathering at Rivière du Loup, Quebec, on June 21, Mayor Camillien Houde of Montreal declared that Quebec hydro-electricity must be cheaper, even if the province has to compete with private interests. Mayor Houde said he favored the appointment of an independent commission of experts to revise electric rates downward. If that were not achieved, there seemed to be nothing left but competition by the state, Mayor Houde, who is the leader of the Conservative party in the province, declared. His remarks have aroused discussion, with sharp division of party opinion.

Campbell River Project

Plans of the British Columbia Electric Railway Company, filed with the Provincial Water Board, for the development of Campbell River, on Vancouver Island, are for an output of 157,000 hp. Three power plants and four dams and the raising of Buttle Lake to a maximum of 32 ft. are planned. This would use virtually the entire flow of Campbell River from Buttle Lake to the sea, or a head of 550 ft. The first step would be a plant at Elk Falls, to produce at first about 16,000 hp. and eventually 93,500 hp. maximum, with 71,000 hp. continuous supply. Elk Falls and Buttle Lake are on park land.

A.I.E.E. Visits the South

Set in the Great Smoky Mountains of western Carolina, Asheville's Grove Park Inn has Mount Pisgah and The Rat in the center of its vista. In the foreground lies a compelling course for the golfers. In this environment 500 electrical engineers last week blended sociability, scenic inspiration and recreation with professional zeal and technical advancement.

EDITORIALS

L.W.W.MORROW
Editor

Impressions of the Institute meeting

EXPLORATION of current trends in electrical practice was the theme of most of the discussions at the A.I.E.E. convention in Asheville last week. Exploitation of new technical details of design was much less in evidence than at the preceding winter convention. The "marktime" attitude of business seems less conducive to courageous announcement of new designs and new schemes than to a methodical study of the probable inability of today's practices to meet the need of tomorrow's invigorated demands. Behind the engineer is the management, and management, infected with pessimism, has curtailed research development programs to such an extent as to leave the eager engineers little to discuss but the industry's established practices. Enthusiastic disclosure of new developments must evidently await the day when the reception will be more warmly responsive.

Not all the thought, however, was put on technical ideas. Engineer registration laws presented an unsought but unavoidable problem. Institute policy on this matter has crystallized in recent months, and the section delegates went away with a clear notion that these laws are more a situation than a theory. The task is to make the situation better for the engineer who deplores the vocational aspersions cast upon him by some of the laws and their administration and aspires to full professional recognition and civic responsibility. Delegates learned likewise that the Institute is about to submit its own province, functions, practices and services to careful scrutiny with a disposition to revamp and remodel wherever changed conditions warrant rather than to remain oblivious of altered circumstances. Such modernization is the watchword of energetic industry, and it should also be the spirit of the assembly of those engineers who make industry energetic.

Technical discussions focused largely on the broader questions of economic interest, with less emphasis on the theoretical foundation for sustained advance of electrical technique. Why should not power utilities concede to communication specialists the capacity to solve both their specialized and routine communication requirements? Why is not the time ripe for standardization in the terminology, concepts, calculation methods and economic aspirations in the realm of wholesale power interchange? In the light of volumes of published research, why should not the utilities have the mutual support of cable manufacturers in reducing cable diameters, lowering their cost, predicting their service life, eliminating the oil-reservoir excrescences and prefabricating joints?

Manifestly the program was both diversified and compatible with the temper of the times. Interest was adequate, but withal there was noticeable a lack of the zest with which electrical engineers are accustomed to canvass topics in discussion. Symposium treatment was carried to its peak at this meeting. With resumption of forward technical progress and presentation it may well prove desirable to give freer play in the program to the individualist and specialist, allocating less space and time to solicited symposium presentation.

Utilities retain public confidence

IT WAS not uncommon a decade or so ago for a public utility company to pay 8 per cent interest to the investors in its securities, and when about five years ago the rate had dropped to 6 per cent comment was made on the industry's improved status in banking circles. Recently

several electric light and power companies have marketed bond issues with facility at the extremely low average of approximately 4 per cent. This record certainly indicates that the public has retained its confidence in the stability of the electrical industry in spite of present business conditions. As a mere matter of fact, this confidence is well founded, for the setback has not been serious. Monthly reports show that earnings are holding up remarkably well as compared with those of industrial organizations, and dividend payments have been maintained on a pre-depression scale with very few exceptions. Such a record the industry can point to with pride. During the first six months of 1931 electric light and power companies offered new securities, including stocks, bonds and notes, totaling $973,945,000, as compared with $745,452,100 for the similar period of 1930, an increase of 31 per cent. Of this sum $346,000,000 represented new capital and $627,000,000 was devoted to refunding operations.

David Edward Hughes—little-known pioneer

THE centenary of the birth of David Edward Hughes was celebrated in Great Britain with fitting ceremonies. This professor of music, who, born in England, passed his youth in the United States, was the pioneer in many inventions—the printing telegraph, the microphone, the coherer. Yet his name is little known in this country, although his printing telegraph was invented while he lived in Bardstown, Ky., in 1854 and was first adopted by the American Telegraph Company in 1856.

Then he went to Europe and sold his printing telegraph to European telegraph companies for sufficient money to enable him to retire to his laboratories for further experiments. In 1878 he read a paper describing the multiple-contact microphone that he had developed and concurrently described the embryonic coherer later developed by Branly. It is also alleged that he antedated Hertz in the discovery of Hertzian waves.

Hughes' career is striking in that he had no scientific background for his work. An inventive turn of mind, an imaginative temperament and a pair of skilled hands enabled him to go far in science because he liked to experiment and because he thought outside the beaten tracks. Undiscouraged by the cold reception granted his ideas by his associate scientists, he went forward to honor and success. He has a high place among electrical pioneers.

The cost of the N.E.L.A. exhibit—and a suggestion

NO SINGLE index presents more clearly the trend of interest in the power industry than the exhibit at the N.E.L.A. convention in Atlantic City. A few years ago the attention of the utility executives was closely focused on engineering and construction, and the exhibit was an apparatus and equipment show. This year it was a domestic appliance show, because right now interest concentrates on the development of residence load. It represented an expenditure by the manufacturers of anywhere from three to six million dollars, depending on how far the estimator may go in figuring the value of time and the costs of travel.

It is easy for a man to say in surprise: "Such an expense is too great a burden." But with an investment in this branch of the electrical industry of fourteen billion dollars and an annual sales volume of four and a third billion, such an expenditure is not too much if it will bring before electrical men the greatest educational opportunity of the convention. For here only do we see clearly, year by year, and in one display on a large scale, the progress of the art. It is the only place where men may study and compare the new technical developments and so many of these appliances that make electric service useful to the consuming public. The only waste that there is in this show is that so few men see it and so little time is given to it.

The manufacturers this year made a notable contribution, considering their present meager profits. It was the most colorful and diversified exhibit in the history of these conventions. It was rich in ideas. It was a splendid demonstration of co-operation and confidence. Unhappily it was not supported as it should have been. For the utilities, whose profits have been little affected, elected to do the economizing for the industry. Several thousand men were not permitted to

attend. The crowd in the exhibition hall was far smaller than two years ago. Exhibitors of apparatus especially were discouraged because so few engineers were in attendance.

The point is this—that such an exhibit deserves better promotion and a bigger audience. It offers more than any single meeting. Why, then, should not a full morning be set aside—without competition—for the study of the exhibit, with a ceremonial review? Some new type of directory could be provided that would dramatize the significance of the show. It could be done, and it would seem as if the manufacturers were entitled to this much support for so valuable a feature of the convention. At the same time, wholesalers and dealers might well be invited to visit the show and gain enthusiasm for the increasing opportunities that these load-building appliances offer to them. The exhibit is worth all it costs. But it can be made to pay far greater dividends.

Ash and gas emission from power-station stacks

MUCH experimental work is going on in Great Britain and in this country to determine ways and means for handling gases and ash from power-station stacks. A current report of the British government surveys the situation without very promising results. The use of expansion chambers has not proved practicable, and water sprays and electrical precipitation methods are expensive to install and operate. A promising development abroad is a patent washer system which depends for its operation upon wetted surfaces collecting dust and neutralizing gases. A battery of tubes is placed in the gas passage, and water treated with a little alkali is caused to run up the tubes and overflow to give a film of water on the outside. To this film fly ash adheres, and the sulphur fumes react with the alkaline moisture to become neutral.

Many suggestions and many researches are helping to accomplish similar results. In this country experience shows that electrical precipitation is the most effective method for cleaning stack gases of mechanical particles, but even so there is opportunity for development and cost reduction, and the handling of fumes and gases presents still another problem. There is no doubt, however, that ultimately effective apparatus to remove the smoke, ash and gas nuisances that mar the social efficiency and popularity of power production must be installed.

Stabilization by example

ECONOMIC depression has brought stabilization of industry and stabilization of employment to the fore, and at Atlantic City the electric utilities took a forward-looking position on these topics. They should do so, for that is both good business and good public relations. Moreover, the utilities are regulated monopolies with a quasi-public character, and for this reason they undoubtedly have an opportunity and an obligation to set a good example in stabilizing both business and employment.

A definite business move toward stabilization is the adoption of a reasonable expansion program by each utility whereby expenditures will create a normal minimum flow of business to the manufacturers that supply the industry. Just now a peak is seen in the effect of an abnormal spurt and an abnormal reaction. The peak expenditures of last year were made in good faith and to live up to a promise, but it would have been better business to have maintained a normal expansion program over the whole period of depression. It is equally bad business, however, to permit expansion to cease now, and a good example would be set all industry if the utilities would go ahead on a basis of normal expectation. Otherwise a surplus in demand is bound to occur when business recovers.

But the greatest opportunity for the utilities lies in the realm of stabilized employment. If they can solve this great national problem, they will contribute benefits of untold value to the existing social and economic structure. No more deserving or intelligent move has been made than the appointment of the committee under Charles L. Edgar to see what can be done. There is every reason to believe that the utilities can establish a stabilized employment plan that would serve as a national example. If they do this, their public relations will be improved and their business efficiency increased. Vigorous and intelligent action should be taken by the committee, and it should be supported wholeheartedly by the industry.

Electrical Engineers at Asheville Examine Prevailing Practices

Five symposia in the seven sessions were devoted to the constructive study of interconnection, power-system communication, cables, electrical units and automatic stations

FEW new devices or practices were reported at the summer convention of the American Institute of Electrical Engineers, held last week at Asheville, N. C. In keeping with the spirit of the times in calling for critical analyses of prevailing practices, engineers, like others, seem disposed to concentrate their thinking on ascertaining the limitations of current methods and revamping them for the day when full activity shall have been resumed and when economic pressure will accentuate any inhibitions pertaining to hold-over practices.

For example, telephone and other communication facilities required by electric utilities are expected to meet exacting requirements and must be accompanied by competency in personnel if acceptable results in dealing with customers, in intercompany and intracompany business and in the technique of system operation are to be obtained. It was, therefore, appropriate that this agency should be scrutinized and steps taken to exchange ideas and facilities or to establish rental arrangements with the utilities specializing in communication. The discussion along these lines was on a high plane of mutual helpfulness.

Interconnection has grown by leaps and bounds, outstripping in some respects the terminology and definitions on which contractual relations are based and economic analyses founded. Opportunity was taken at one of the sessions to promote measures toward standardization of the concepts and the language, as well as to set forth the fundamental economics, of power interchange.

Operating technique in interconnection has its attention focused on such matters as frequency control, maintenance of time correlation, mastery of power flow and supervisory control, remote metering and switchboard schemes. These matters were on the program and provoked active discussion from the large group present.

Cables are likewise in a mild state of flux and therefore subject to scrutiny. The oil-filled cable has been an almost phenomenal success. Elimination of the air and moisture has permitted it not only to succeed at the higher voltages but also to encroach economically on the province of the solid type of cable. Progressive reduction in insulation thickness of the oil-filled type raises the question why similar gain in cost and dimensions should not be offered in the solid type.

Other topics on the program involved the transition from physical to absolute bases for the fundamental electrical units, characteristics and limitations of cells and potentiometers, new methods of calculating synchronous-machine constants, survey of experience with automatic stations and miniature switchboards.

Terminology and Technique in Interconnection

TERMINOLOGY in the realm of interconnection was advanced several stages nearer complete clarity and ultimate standardization by the papers and discussion in a symposium on this topic. Especially was this true of a paper by A. E. Bauhan, who advocated classification of interconnection services into seven main categories. With such a start the definitions will simplify all contractual language and render operation easier by eliminating ambiguities. Classifications advocated are:

1. Emergency service.
2. Load diversity.
3. Firm power.
4. Storage power.
5. Intracompany use.
6. Economy flow.
7. Unintentional flow.

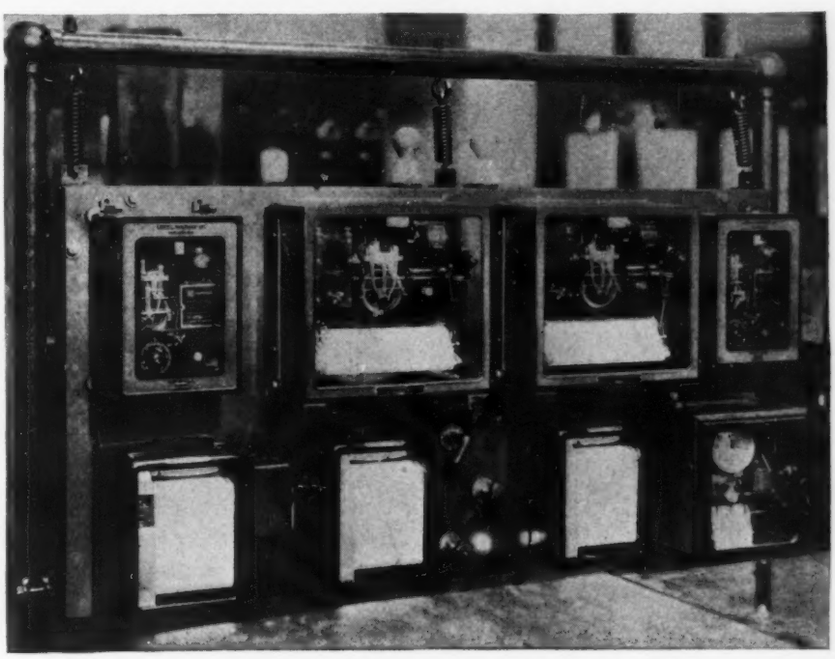
H. G. Harvey was disposed to urge the recognition of two kinds of emergency service, one a steady-state emergency and the other a transient-state emergency, differentiated principally by their duration and the degree of opportunity to prepare for them. Following acceptance of the definitions there will be occasion for agreement on the accounting in order that the economic evaluation of interconnection services shall proceed on a uniform basis. Fixed charges are often cited in the range from 10 to 18 per cent for steam generating stations and from 8 to 19 per cent for substations, according to M. M. Samuels, who is disposed to question the necessity for assuming such wide ranges. He also pointed out that high investment is not always justified even if it does insure low production costs. In the present business depression, it was contended, the uncertainty of the immediate future should act as an incentive to increased interconnection in order to conserve investment in generation.

In the experience with interconnected operation it was admitted by several speakers that production expense savings had proved relatively less important than capital savings. The real problem in the economies of interconnection is always the uncertainty of future loads. System planning may be made for ten or fifteen years ahead, but in Mr. Bauhan's experience few companies have adhered to such plans for more than three years. This is an unfortunate obstacle to ideal attainment of interconnection. However, the disadvantage is offset by the fact that savings associated with emergency conditions have been twice as great as from transactions involving economy in flow of power. Production economies are probably not over 5 per cent of the total benefits.

Contractual restrictions and operating difficulties make tie-line swings undesirable. In a large extent they are attributable to uncertain frequency and insufficient control. Subsequent to the installation of automatic control at the Windsor station an immediate change was experienced in the character of operating technique on the tie-lines of the Penn-Ohio-West Virginia system, according to H. S. Fitch. When the automatic devices were installed constant adjustment of transfer conditions gave way to more occasional adjustment. The installation did, however, cause greater load swings at Windsor, the point of control. It was therefore determined to install similar equipment at several other points and thus localize the load effects on frequency. Swings have decreased to less than half the values with single frequency control. Tie-line operation has been smoothed out and time is being held closely. Four million kilovolt-amperes of capacity are now under automatic frequency control for from sixteen to twenty-four hours per day.

Two diverse views are held on the value of refined frequency control and its rigid applications to large interconnected systems. Ten distinct systems are participants in the Pennsylvania-Ohio-West Virginia interconnection, and it was the success with master frequency control at the Windsor station which prompted the decision to have the control extended to other key points in the system. W. C. Mangels of New Jersey took issue with H. S. Fitch of Pittsburgh on this point and advocated a greater degree of freedom for play of the forces which alter the frequency behavior. He recited an instance when the New England-New Jersey-Pennsylvania system accidentally was left without frequency control at any point without noticeable difficulties being encountered. Load division was normal, frequency was satisfactorily maintained, and even reactive flow was in keeping with the desired results.

In general, however, the disposition is to apply frequency control more extensively, even though it is



Frequency automatically controlled

Panel shows recording of frequency, time and tie line loads. Actuating governors of four 30,000-kw. units, this automatic equipment holds frequency within one-fortieth of a cycle of 60.

acknowledged that it does not solve all the problems of power flow and power drift. New interconnections frequently disrupt the established régime of load and frequency control. E. E. George cited the situation in the Alabama-Georgia ties, three of them originating at one point in the Georgia system but terminating at different points in the Alabama system. When power flow is from Georgia to Alabama regulation is not difficult, but when circumstances call for a reverse flow not only is the control more difficult physically but it accentuates the limitations of the communication system.

Periods of rapid load change are the most difficult to handle. It looked to Mr. George as if it would ultimately be necessary to provide direct communication from important line substations to the generating stations at distant points without routing through a multiplicity of system load dispatchers.

Problem now is standardized time

The precision of frequency control has advanced to the point where the departures are less than for the various time standards. At Windsor the largest deviation from Arlington standard time during one month was three seconds. This is so close that the present departures in time systems indicate the desirability of adopting and transmitting either a single standard time or a single high frequency over communication networks.

Most essential of all elements contributing to successful interconnection operation is the spirit of mutuality, confidence and friendliness which dominates most of the relationships of the system operators involved in interchange transactions. Specific contractual provisions and methodical load scheduling are likely to go for naught unless the operators are familiar with one another's conditions and even personalities. For this reason many, including W. C. Mangels, I. E. Moultrop and H. S. Fitch, cited the benefits derived from frequent conferences of system operators engaged in systems which are interconnected. Prof. S. S. Seyfert of Lehigh even suggested that could the public but know of the unselfish zeal with which system operators strove to attain power economies and conspired mutually toward this end, much of public suspicion about a "power trust" might dissolve, especially if it were realized that these economies are part of the trend toward lower rates for ultimate service.

Insulation Thickness and Cable Joints

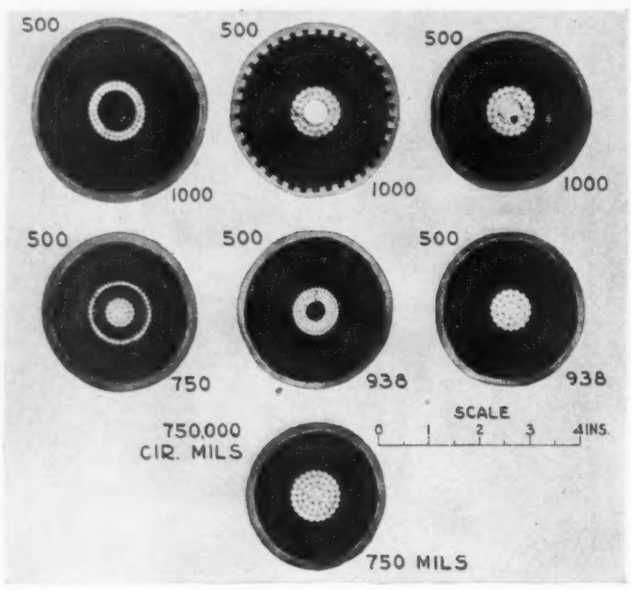
CABLES are going to have their insulation thickness reduced, if the discussion at the cable session is any index to prevailing trends; condenser flux control will be applied to cable joints, and more accurate prediction of cable failure will be possible and thus indicate service life more reliably.

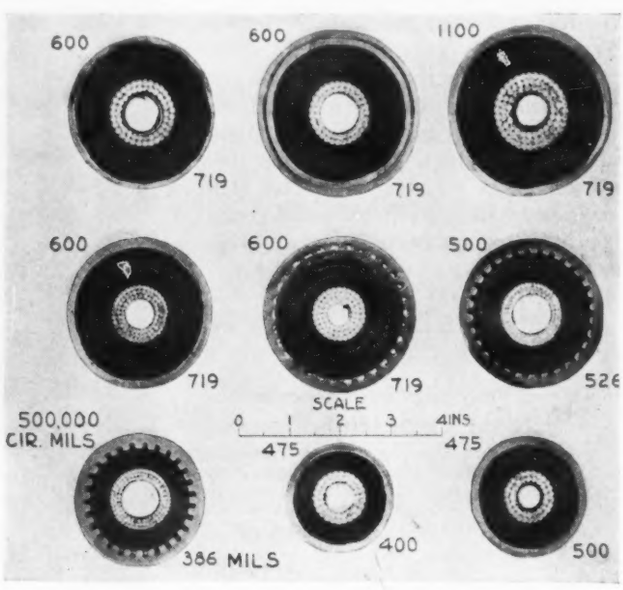
The suggestion that progressive reduction in oil-filled cable diameters warrants a corresponding reduction in ordinary solid-insulation cables brought out considerable diversity of opinion, manufacturers in general being much less enthusiastic in this view than users. D. W. Roper, however, said that this country had had 300 mile-years of perfect performance with oil-filled cables. An equal amount of good experience with solid-type cables should, in his opinion, justify as much readiness to attempt smaller diameters with one as with the other type. The range of overlap in economic merit of the two types of cables is today too great, Mr. Roper held, and he showed how simplification of the oil-reservoir system and lowered price for ordinary cables would improve the relative situation of the two types. His paper, abstracted on page 27, was supplemented by a report on the tests conducted on samples of new cables submitted to the Commonwealth Edison Company for subjection to repetitive load cycles at 132 kv. One sample of ordinary 66-kv. cable, designed and sold for use at that operating

Tests show feasibility of thinner insulation

Left—Six upper samples are experimental 132-kv. cables fabricated especially by various manufacturers for test by Commonwealth Edison Company. Single lower is 66 kv., being operated successfully at 132 kv.

Right—The 719-mil cables are commercial products designed for 132 kv. and are in commercial oil-filled service. Three at bottom and one of 526 mils were designed for experimentation to ascertain limits of stress and temperature for oil-filled insulation at 132 kv. leading to design of 220-kv. cables.





voltage, had given satisfactory performance at 132 kv., and this fact lent considerable weight to the argument that insulation thickness can safely be reduced.

Factory-made joints

Progress toward a factory-made cable joint was reported by R. W. Atkinson and D. M. Simmons. The stop joint, the terminal and the ordinary splice joint can all be adapted to the condenser method of dielectric stress control as commonly employed in condenser bushings. Concentric cylinders combined with annular rings and conical end-pieces are reported to be effective in keeping the stress lines radial, and thus they prevent joint failure by avoiding subjection of the insulating tapes to longitudinal stress.

A paper by Prof. M. C. Holmes offered a method of analysis whereby the variability of behavior of a given cable under given conditions can be employed to predict the probable breakdown voltage and allowable operating voltage. The method may be used to compare the relative merits of different cables and permit the establishment of appropriate safety factors. That this index has value was asserted by F. A. Brownell. He added that he was disposed to use the seventh-power time relation for belted cable and the sixth-power relation for shielded-conductor cable and had found only 2 per cent variations in general from the sixth-power law. In one instance it was calculated that failure under test would take place in 25 hours; actually the failure happened in 24 hours 50 minutes, an agreement almost too good to be believed.

Stopping the tests short of puncture was advocated by W. A. Del Mar. As an indicator of incipient or imminent failure he coats the cable with a mixture of paraffin and red lead, which melts at 60 deg. C. When the hot spot forms at any place and thus will lead to failure at that point, the paraffin melts. Internal examination is then possible and the wrappings can be studied for dendrites or other evidence of overstress. Incidentally, he said, the dendrites are never found in oil-filled cable.

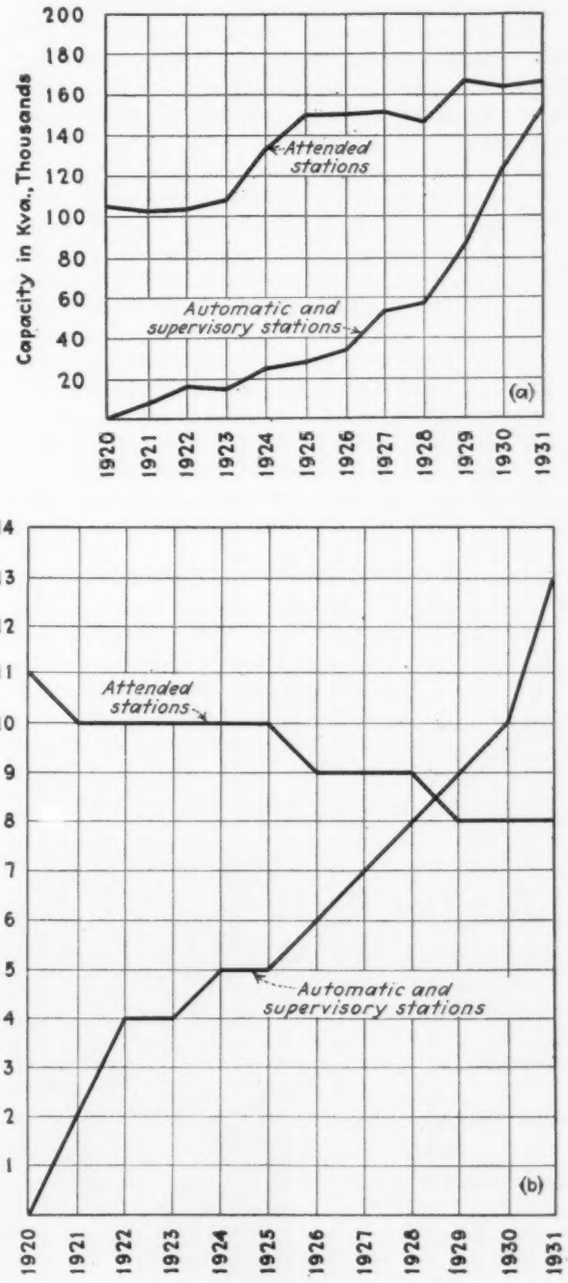
Power factor should be good from start

In most instances the power factor of the 132-kv. cable reported upon by D. W. Roper showed lower power factors as the tests progressed. Dr. J. B. Whitehead stated, however, that it was more desirable to have the power factor flat from the start than to have improvement take place. Cables which can be classed as poor show a rising power factor from the start, the ozonization of the residual air by corona aiding the oxidation of the insulation and increasing its conductivity and losses.

With respect to the matter of pressures used in connection with oil-filled cable it was indicated that impregnation pressures are of as much importance as low values of absolute pressure during the evacuation pressure. It is in these values that laboratory test technique may differ widely from commercial production practice. Mr. Roper also brought out the fact that sudden changes in load cause a lively flow of oil between cable and reservoir. With piping too small in diameter the pressure at mid-points of cable lengths might barely be above atmospheric; thus, replacement of 0.3-in. tubing by 0.5-in. gave 4 lb. pressure at the mid-point instead of almost zero when the reservoir pressure was 10 lb.

Automatic Stations

MAINTENANCE is the most important factor in the successful operation of automatically operated and supervisory controlled substations. This conclusion was apparent both in the papers and the discussion of the session devoted to this topic. Garland Stamper and F. F. Ambuhl made the point clear in their recitals of operating experience with automatic stations on the systems of the Columbia Gas & Electric Corporation and the Toronto Hydro-Electric System. Both papers recommended automatic operation with very little qualifica-



Figs. 1a and 1b—Automatic stations supersede attended type

Automatic stations on Ontario system have grown to parity in rating with attended type, but exceed these in number.

tion as a means for securing improved service, continuity and a decrease of operating expense, and they agreed that these systems "when operated properly are equal to and in some respects superior in reliability and flexibility to attended stations."

Perhaps before these optimistic conclusions will be wholly accepted by electrical engineers generally there will have to be much more of what E. J. Rutan, in discussion, declared is necessary. This is the full and free exchange of operating experiences by every means available so that new users of these systems may know what to expect and what not to expect of them. Another important point brought out by Mr. Rutan was that most of the instances of trouble recited by Messrs. Stamper and Ambuhl were concerned with equipments and devices not special to automatic operation and that it was unfair to charge failures of meters, switches and other common devices to automatic operation, since these things were in common use long before and operators should know all about them.

Three years' operating experience with miniature switchboard supervisory automatic control on the Ohio Falls station of the Louisville Gas & Electric Company, recited in a paper prepared by R. M. Stanley and read in his absence by F. H. Lane, indicated that the day of the long station switchboard is passing. Numerous tables showing operations of devices included in the system, with notes of failures, gave great evidential value to Mr. Stanley's paper. The conclusions of "saving in time during regular operations," "elimination of human errors," "saving in labor costs," "low cost of maintenance and inspection" and "better and safer supervision and operation" were apparently well justified by the data exhibited. This paper appears in abstract on page 22.

Combustion control proves itself

That the electrical engineer is being brought more frequently into the boiler room of the generating station through the use of automatic combustion-control systems was the impression derived from the paper on this subject by C. H. Sanderson and E. B. Ricketts and read by the latter. These systems, although capable of operation by other means, are more and more becoming electrical. In discussing this paper I. M. Stein mentioned that it would soon become necessary to give attention to the co-ordination of design of electrical devices included in these systems to fit into the special duties required of them. F. H. Hollister said that while it was difficult to evaluate the advantages of automatic combustion control in terms directly comparable with previous operation, the job should be done in order to justify installations. He cited as an example an improvement of 4 per cent attained in the performance of one boiler.

Most supervisory control systems are operated by direct current, this being accepted as more reliable. However direct-current supply involves a storage battery, which is usually the greatest maintenance difficulty. A new Brown-Boveri development using alternating current was described by O. K. Marti. This system utilized an oscillatory motor moving at system frequency as the mechanical actuating means to operate selector switches. Included in this development is a reproduction of the system controlled to give visual indications to the operator of all switching and other performances.

Communication for Power Systems

GROWING consciousness that the communication requirements of power utilities are distinct from the routine technique of the telephone companies, but nevertheless founded on principles which the latter have carried to a high degree of perfection in practice, was manifest in the session devoted to this subject. A joint paper prepared by two members of the communication group and two of the transmission distribution group analyzed the types of service which power utilities require. This is abstracted on page 19. Other papers in this symposium described various phases—customer service, load dispatching, etc.—of the Niagara-Hudson, Commonwealth Edison, New England Power and Arkansas systems. These private systems of communication co-ordinated in varying degrees with the public telephone service have grown up under the exigencies of necessity, but the disposition appears now to be to scrutinize them carefully to ascertain how much

Fig. 1—Buffalo's customer order table

All customer telephone calls regarding connections and disconnections of service, interrupted service, bill complaints and requests for information are received and handled expeditiously, systematically and tactfully.

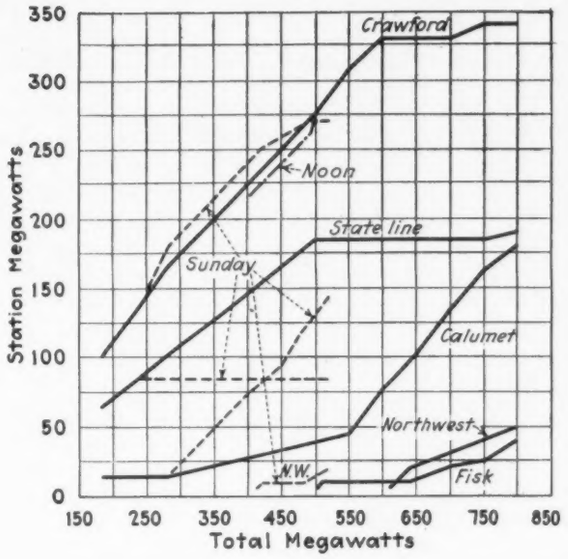


Fig. 2—Scheduling Chicago's load

Each station is given such a chart to show every station's individual responsibility at all prospective values of system load.

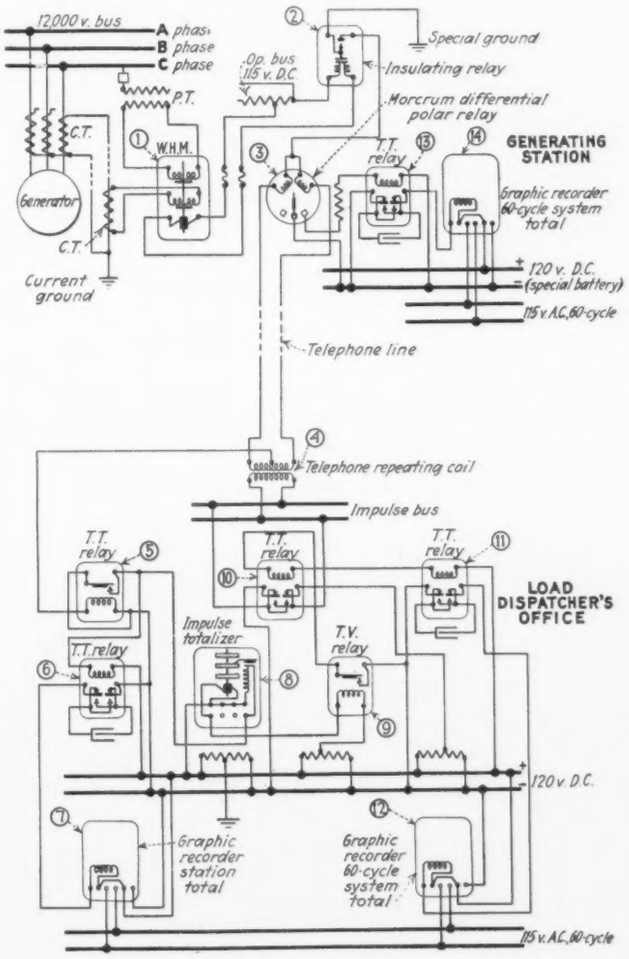


Fig. 3—Each station knows system load

Remote metering scheme in which watt-hour meter (1) sends load dispatcher impulses proportional to each station's load; impulses are collected on impulse bus and accumulated on impulse totalizer (8); then system total is communicated to all stations by T. T. relay (10).

benefit can be derived from a greater degree of co-ordination with the established communication services.

One problem that hampers fuller co-ordination is the higher noise level on power utility telephone circuits. Lower noise level is the ultimate solution, said E. E. George, but temporarily it is impossible to escape the higher level. H. O. McGrath suggested filtering out the noise.

Reliability of service is another essential element of the problem. Separate cable routes for multiple channels are desirable to assure reliability. H. S. Fitch urged the value of continuous and automatic record, broker-tape fashion, of the conversations in connection with important load-controlling operations. He also pointed to the need that communication circuits be adaptable to these schemes. Remote metering is growing, and it is logical to delegate it to the established communication system whether privately owned, rented or subscribed.

Supervisory control can less readily stand interruption than can the metering functions of these circuits, in the opinion of G. M. Keenan. In order that such assurance against interruption shall be attained, C. E. Steward expressed the opinion that it would be very desirable to identify and label the lines leased for these purposes so that maintenance gangs would give them preferential treatment and disturb them only in pre-agreed circumstances.

In general, the discussion revealed the fact that there has been little progress toward standardization in the matter of communication for electric utility companies. Much of the development has been calculated to meet special situations; in turn, the systems devised have been altered as new requirements have arisen. Intricacy, in many instances, has entered to such an extent as to make a wide-range co-ordination imperative. At this point it was recognized that the experience of the specific communication companies can be of timely assistance in advising, co-ordinating or leasing the facilities.

Electrical Units and Measuring Apparatus

CHANGES impending in the statements of fundamental electrical quantities to bring them to a degree of accuracy more in line with the basic units of length, mass and time as expressed in the c.g.s. system added greatly to the interest manifested in the papers in the symposium on electrical units and inspired much animated, if abstruse, discussion of them. L. T. Robinson, speaking on the subject of "Electrical Units and Their Application," expressed his own satisfaction with the accuracy of the basic c.g.s. units and was hopeful that the electrical fundamentals could finally be revised to a meticulousness approaching them.

With the opinion expressed by H. B. Brooks, in his discussion of "The Unit of Electrical Resistance, Its Past History and Impending Change," that the mercury column would be discarded as a resistance standard, Mr. Robinson agreed. According to Mr. Brooks, "The technique of absolute determinations has improved until now it may fairly be said to be at least on a par with the mercury ohm as to reproductibility." T. F. Ball disturbed the complacency with which these two papers were accepted by adverting to the Einsteinian space-

time concept as a modifier of the infallibility of the basic c.g.s. units. This metaphorical pin on the seat of the chair was removed by Mr. Robinson, who said that the determinations were less concerned with space-time relationships than with the entities themselves.

Low versus high resistance in potentiometers

A comparison of virtue as between the high- and low-resistance potentiometers was the thread of continuity in an excellent paper on the design of these devices by L. Melville Stein. Mr. Stein was much of the opinion that the low-resistance type is the better of the two, both in point of manufacture and in operation. This impression was not allowed to pass without question, particularly in the discussion of the paper by Gordon Thompson of the Electrical Testing Laboratories, who stated it as the experience of the laboratories that the high-resistance type had been found perfectly satisfactory as day-by-day operating instruments of precision and had also been found, by tests of some in use for many years, to have held their resistance characteristics unchanged for very long periods.

For full information on the design and operation of standard voltaic cells the paper by Marion Epply will probably become a classic in Institute literature. After Dr. Epply had finished there was not much left of the subject to discuss. Drs. Brooks and Kouwenhoven, however, did bring out from their experiences two significant points concerning the proper use of the cells. The former advised periodic measurements of internal cell resistance to be sure that all gas bubbles had been eliminated from the liquid before use. Dr. Kouwenhoven emphasized the necessity of protecting the cell from unequal temperature variations by some means of lagging, such as a cork jacket. The condition to be avoided is not so much heat changes affecting the whole cell as difference in temperature between the poles. In this connection Dr. Epply advised the inclosure of the cell in a heavy copper container inside the cork or asbestos so that heat affecting the cell may be uniform at all points.

Electrical Machinery Design Constants

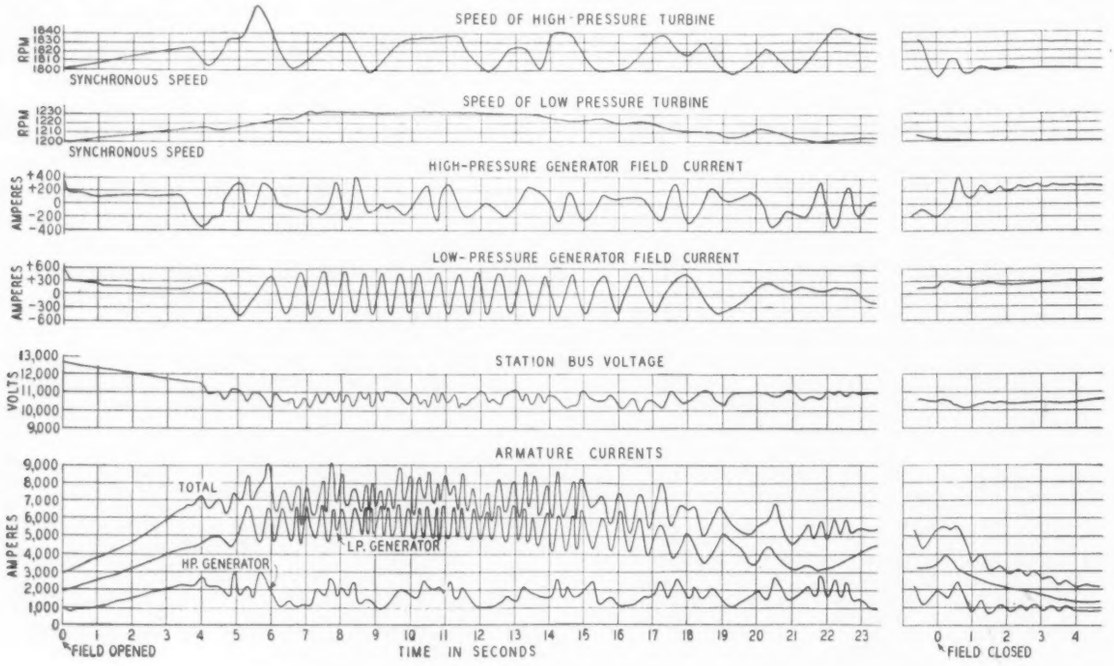
ORDINARILY when the field circuit of an alternator operating in parallel with others has opened it has been the practice to take the unit off the system, re-excite it and resynchronize. Tests at Chicago reported by D. D. Higgins and E. Wild, however, indicated that no trouble or distress has resulted from releasing the field switch while the alternator is still in parallel. Questionnaires to other companies brought answers that experience did not indicate that this was not a safe and justifiable operating procedure.

A paper by S. A. Kilgore presented a comprehensive procedure for calculating the constants of synchronous machines which affect their transient characteristics. The mathematical expressions derived are based on physical conceptions of the actual currents and flux fields involved. A companion paper by S. H. Wright treated test methods and disclosed satisfactory correlation of the test results and calculated values.

Ernst Weber, exchange professor at the Brooklyn Polytechnic Institute, submitted a complete mathematical solution for the sudden application of alternating-current voltage to an electromagnetic circuit embracing partly air gap, partly solid iron and partly laminated iron in its core. One significant field of application of the results is in connection with quick-response excitation of large synchronous machines. Other fields of usefulness for the new mathematical approach lie in the design and behavior of large direct-current motors in reversing-mill service. Short-circuit calculations for large alternators are also rendered more precise by the supplementary procedure presented by Professor Weber.

Re-excitation of bussed alternator is practicable

60,000-kw. cross-compound unit carried 50,000 kw. at 80 per cent power factor when field was opened. Armature currents go to thrice normal and field currents to double.



Unifying Communication for the Operating Job*

By R. N. CONWELL,[1] G. M. KEENAN,[2] C. F. CRAIG,[3] E. C. BRIGGS[4]

EFFECTIVE co-ordination of the activities of an electric utility necessitates the establishment of communication channels for the continuous flow of information into organization centers and the prompt transmission of orders and suggestions from these centers to the points where action is taken.

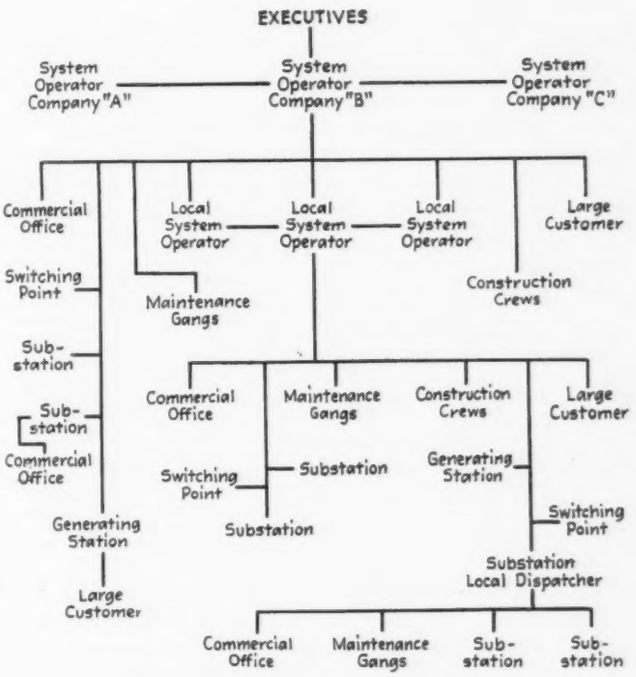
The work of an electric utility may be considered as divided into three classes of activities:

1. Operating activities, including dispatching, generating and substation operation, emergency line patrolling and repairs.
2. Customer service activities, including new installations, disconnects, moves, service complaints and comments.
3. Administrative activities, including administrative sales and business functions as differentiated from the service functions.

The communication facilities for operating activities need to be:

1. Easy to operate and so arranged that communication service can be established quickly.
2. Available at times when generating and distributing facilities are in trouble and, therefore, as far as possible, not subject to the same hazards as power facilities.
3. Of such quality as to avoid misunderstandings and permit conversations to be carried on with ease.
4. Safe for use, but not so protected as to be unavailable for service during electric service difficulties.
5. Of sufficient capacity so that under the worst emergency conditions no serious delays will be experienced in restoring electric service.

Heavy or important traffic requires the establishment of direct channels. Two or more independent paths are essential where continuous service is to be provided. One of these paths may be designated as the regular or direct route over which a satisfactory grade of transmission is required at all times. The other or back-up route may provide a somewhat lower grade of transmission, but it must be satisfactory for the handling of essential communication during times when the regular route is not available.



A communication scheme to meet operating requirements

Many operating points, such as generating stations and substations, require communication between their central control station and other locations on the same premises. For example, in a large substation the power switchboard is usually the central control point, with communication facilities required between that point and repairmen's quarters, high-tension room, pump house and switch yards, and possibly other locations. In generating stations communication facilities are required from the central point to locations where coal and ashes are handled, to the boilers, turbines, pumps, switch yards, etc.

Dispatchers require communication channels to practically all operating points on the system and, in certain cases, to locations along the transmission lines, to the various departments and officials of the company, to large power customers and to system operators of interconnected utilities.

Various equipment arrangements have been provided

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*Abstract of paper presented at the summer convention of the A.I.E.E., Asheville, N. C., June 22-26, 1931.

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at dispatching points for the termination of communication channels.

Little progress has been made toward standardizing equipment arrangements for load dispatchers. Considerable study of existing installations and analysis of results obtained will be necessary before definite conclusions can be drawn as to the arrangements which are most desirable.

Disturbances occurring on a power system may make it necessary to reach patrolmen and line foremen to perform switching operations and emergency repair work. When a power line has failed it is the usual practice to patrol simultaneously small sections of the line to determine the location of the trouble. After the trouble has been localized and repair work started need may develop for communication between the repair crews and the dispatching point. Communication facilities necessary in this connection have been provided in several different ways. Patrolmen have been furnished with portable telephone equipment suitable for connection to open-wire communication circuits at any point along the power line right-of-way.

Other companies have considered the portable equipment too cumbersome and have established permanent communication stations along the transmission lines. These permanent stations have been connected in most cases to lines along the right-of-way, in a few cases to spur lines connected to trunk lines off the right-of-way, and occasionally to antennas used in connection with power line carrier-current channels. Detailed reviews of representative reports of patrolmen indicate that the need for separate communication circuits for this purpose may be overemphasized.

Telemetering gaining in favor

The value of telemetering, remote indicating and supervisory control services in effecting centralized control of a power system is rapidly gaining wide recognition. Where long distances are involved, apparatus operated by direct current over separate channels or by means of impulses sent over narrow frequency channels appears to be the most economical. For shorter hauls the cost of conductors is usually not controlling, and simple terminal apparatus using separate wires for each metering or control service seems to be the most economical and desirable. Since large investments in power equipment are normally involved, and manual assistance cannot be obtained quickly at unattended stations, the conductors used must give reliable service.

The present methods of regulating frequency are not considered satisfactory in some of the larger electric systems. Arrangements are desired which will permit the sharing of frequency control by several generating plants or possibly, in the ultimate, provide for load distribution to stations on an automatic basis in direct proportion to the relative costs of generation. Apparatus has been installed and tests are under way to determine the possibility of obtaining independent regulation of frequency at each generating plant to such close limits that more than one station can share in the frequency control. Another plan which has been suggested contemplates the use of a constant frequency supply which might be furnished over communication channels and used to synchronize frequency-controlling devices in generating plants. A quartz crystal oscillator circuit used in conjunction with vacuum tube circuits for control would probably provide the most stable and conveniently controlled source of constant frequency. A standard, now available in laboratory form has a frequency stability of approximately one part in ten million or about three seconds in one year. This apparatus, together with suitable telephone conductors or channels, should provide a satisfactory means of synchronization for power-frequency-control purposes, should the need develop.

Customer best handled by special group

Customers are best satisfied when they deal with employees of the electric utility who can understand their problems and satisfactorily present the utility's attitude and service objectives. Experience indicates that the establishment of an organization especially trained and assigned exclusively to deal with the customer over the telephone is a most effective means of personalizing the service. Where this plan is in effect, all customer calls are routed to this personnel. Male attendants are considered necessary by some companies due to the character of the calls received and the feeling that men have a better understanding of technicalities. However, groups of trained female attendants have been assigned to this work with considerable success in a number of organizations recently established. Their generally pleasing method of handling telephone contacts tends to eliminate any feeling of irritation which the customers may have and usually leads to a mutually satisfactory disposition of the calls. Under this plan of centralized handling of customer calls direct observations can be made to determine which practices are most effective in building up good will among the customers. Any desirable changes in practice can be put into effect quickly on a uniform basis.

Communication services are required by the electric utility for the handling of what may be broadly considered as administrative activities which include executive, legal, engineering, sales and accounting matters, together with certain features of the operating work where speed of action is not the governing factor. The electric utility's territory is divided into divisions and districts, with offices in central locations responsible for the conduct of administrative affairs over considerable areas. Communication service is required to keep these offices in touch with field forces and headquarters and to maintain the necessary contact with other business concerns and individuals.

The type and volume of administrative activity handled by telephone generally necessitates extensive circuit and equipment arrangements. These communication facilities usually are provided by the telephone companies and it is important that the electric utilities make their objectives and requirements clear to the telephone companies so that the arrangements provided will accomplish the desired results.

It is usually possible to install in the private branch exchange switchboard circuit and equipment arrangements for holding conferences by telephone.

Convenient switching plans are available which enable the secretary at a master station to answer and hold one or a number of controlled stations. The controlled station may have access to the master station line if desired. Switching plans are also available which allow an employee at one desk to answer calls on other lines without leaving his desk.

Cable is relatively free from trouble during storms and is considered a desirable type of facility. Open-wire channels are normally considered less desirable from the standpoint of continuity of service. Open wires have been strung on the structures carrying power circuits or on separate poles along the power line rights-of-way. It has been the experience that open-wire circuits thus situated are normally subject to a large amount of interference, and disturbances occurring on the power wires may put the telephone circuits out of service completely at the time when they are most urgently required. In other cases the failure of telephone conductors has put the power lines out of service. As a result of these experiences and the improvement in other types of communication service available for the purpose there is a growing disinclination to rely on open-wire telephone facilities routed along the same right-of-way with the power facilities over which service is to be protected.

Communication channels are also provided for the use of electric utilities by means of power line carrier-current telephone apparatus. In a number of instances during storm breaks, power line carrier has provided the only means of communication available, and it is generally considered a reliable form of service.

Probably the chief difficulty experienced with carrier is the variation in quality and volume of transmission. The power line is not usually a simple circuit, but, rather, is a part of an extensive high-voltage network and any switching or circuit changes in the network alter its communication characteristics.

Opinions as to the value of carrier current differ and further experience is necessary in order to arrive at generally satisfactory conclusions as to the extent to which carrier current logically may be employed in an electric utility's communication system.

In formulating a basic plan, it is highly desirable that close contacts be established for the interchange of ideas and information and for co-ordination of action by those concerned with the development, operation and maintenance of the electric utility's communication service. All departments of the electric utility are involved, together with the companies supplying communication services and facilities.

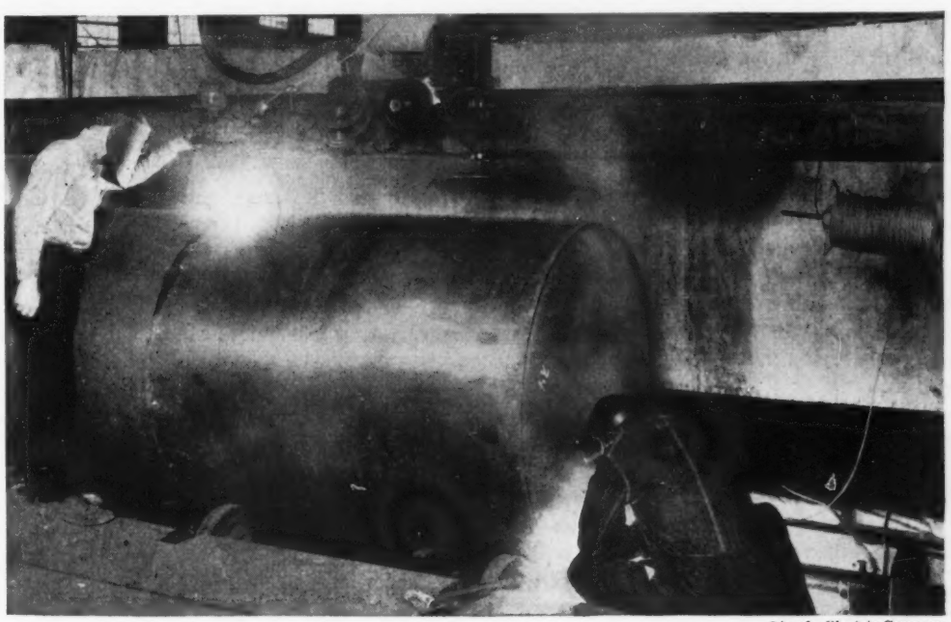
It is desirable that the basic communication plans adopted by electric utilities be developed along consistent lines. The extensive interchange of power between electric utilities and the frequent consolidation of operating properties is emphasizing the need for some degree of uniformity in the communication arrangements adopted by the various operating units in the industry. Each electric utility should determine its requirements for communication in the light of the over-all objectives of the electric industry and should estimate for its particular territory what will be the probable effect of proposed changes in the territory served, in organization and in power operating practices upon its specific needs.

In some companies, however, the needs of the operating department have appeared to be of sufficient importance and the traffic so heavy in volume that a communication network has been provided for the exclusive use of that department. In other territories where this has not seemed practicable convenient switching arrangements have been installed which allow the operating department to seize quickly and hold any desired circuits for an indefinite period of time. These arrangements permit the exclusive use of circuits by the operating personnel whenever, in their opinion, such use is necessary and would seem to provide in effect the equivalent of an exclusive communication network.

Establishment of basic plan

The data obtained by analyzing the communication service required in connection with the various activities of an electric utility, as outlined in previous sections of this paper, provide the material for the preparation of a basic communication plan.

The establishment of such a plan requires the exercise of judgment to evaluate the relative importance of the various activities of the utility and the extent to which available communication services and facilities can be used practicably to expedite such activities. The value of the plan adopted will depend upon the quality of judgment exercised. It is extremely important, therefore, that the best available knowledge and experience in the power and communication field be enlisted in establishing a basic plan.



Lincoln Electric Company

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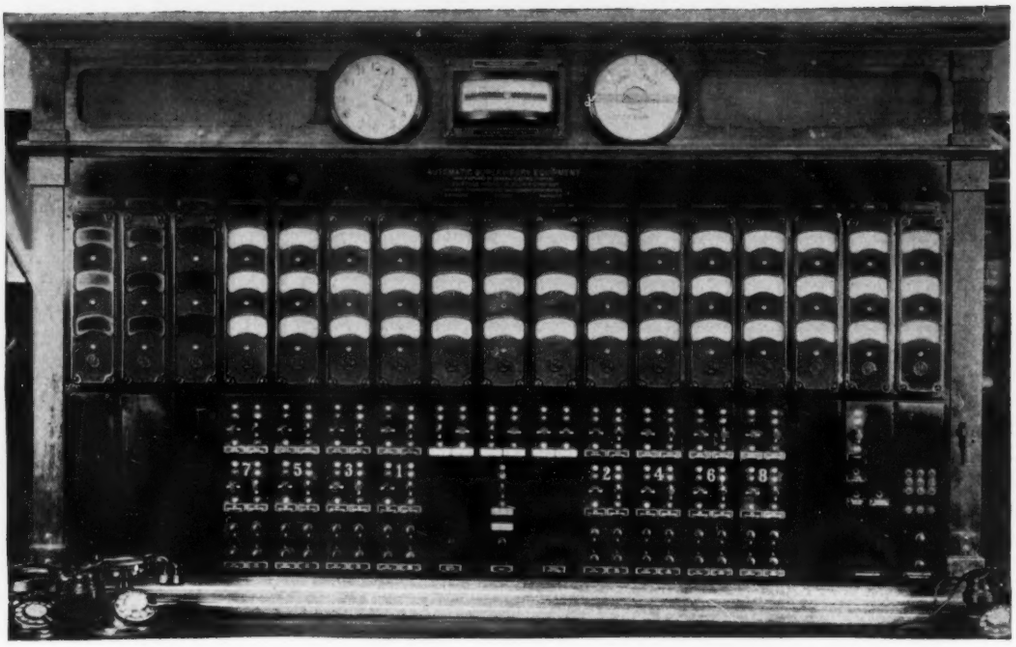
Arc Welding in Boiler Production

Simultaneous automatic arc welding of head and girth seams of small boilers saves time and production cost in the plant of the Novelty Steam Boiler Company, Baltimore, Md. Note the arrangement for lengthwise movement of the girth seam welder and the rolls for turning the work. The reels of welding rod obviate interruptions that would be imposed by the use of the customary short rod lengths.



Miniature board has 4-in. panels. All indications and controls within 2½ ft. radius of Louisville operator. Better loading, better frequency, better supervision of hydro result

Miniature Supervisory Control Gives Creditable Performance*

By R. M. STANLEY
Electrical Engineer
Byllesby Engineering & Management Corporation, Chicago

ENGINEERING reasons for adoption of miniature supervisory switchboard control and automatic control were to reduce initial capital expenditure and lower fixed charges. The results of more than three years' continuous operation of this equipment show the following:

With the miniature switchboard the operator is at all times closer to indicating instruments, control switches, etc., and can give better and closer supervision to the operation of the equipment, resulting in better voltage control, frequency control and division of load among generating units.

There is a great saving in time during regular operation and human error is largely eliminated.

There is a marked saving in labor costs, since there is only one shift operator required to operate the entire station.

Maintenance on the miniature supervisory board is no greater than on vertical boards of older types and, as far as comparisons can be made, appears to be less. Very little trouble has been experienced, apparently slightly less trouble than on older types of boards, although this installation was one of the first used in a large generating station. During system disturbances the operation of the miniature switchboard, as compared with a modern switchboard of standard power house type now in service in Waterside steam station (92,000-kw. capacity), indicates that the miniature supervisory board is more convenient, saves time, reduces chances for error and results in quicker restoration of service.

The use of automatic devices controlling the electrical equipment, waterwheel governor, oil pressure, bearing water pressure, etc., has demonstrated its reliability, low cost of maintenance and inspection, saving of time, saving of operating expense and better and safer supervision and operation of electrical equipment than would be possible by the use of manual system of control.

This operating experience indicates that hydro plants or steam-generating stations can be supervised from miniature switchboards with or without automatic features. It is believed that, in hydro plants, where units are taken off and put on the bus regularly and frequently, this type of control equipment is not only superior to manually operated equipment but the plant will be operated with greater safety to equipment.

**Abstract of paper presented at A.I.E.E. summer convention, Asheville, N. C., June 25, 1931.*

The Ohio Falls hydro-electric station at Louisville, Ky., contains eight hydro-electric units, each having a capacity of 13,500 hp. at 37 ft. head. Each generating unit is complete in itself. Waterwheel, generator, exciter, governor, electrical control, oil and water supply, oil circuit breakers, etc., are individual to each generating unit and all related unit auxiliaries are fed entirely from that unit.

A hydraulic control unit and an automatic electrical control unit are located near each generating unit. The electrical control equipment is similar to that used in all stations, but in each case is placed inside of a sheet steel cubicle located adjacent to the governor.

Table I—Supervisory Board Performance Record

No. in Service	Equipment	Operations per Year	Failures	Trouble Charged to Manufacturer	Trouble Charged to Operation	Year
39	Push-button control load and voltage	80,000	2	None	2	1928
		90,000	2	None	2	1929
		74,000	None	None	None	1930
37	Telephone type control keys	6,022	2	2	None	1928
		5,500	10	None	10	1929
		4,750	None	None	None	1930
78	Polarized telephone relays	9,948	30	30	None	1928
		8,300	5	5	None	1929
		7,590	None	None	None	1930
32	Voltage and load control contactors	80,000	None	None	None	1928
		90,000	None	None	None	1929
		74,000	None	None	None	1930
24	Generator meters, kv., kw. and r.kva.	122,676 hr.	Per cent accuracy of full scale 1 per cent	2	None	1928
		136,245 hr.		2	None	1929
		101,715 hr.		None	None	1930
7	Selsyn meter, kv., kw. and r.kva.	33,728 hr.	Per cent accuracy of full scale 1½ per cent	None	None	1928
		25,888 hr.		None	None	1929
		29,712 hr.		None	None	1930

Table II—Performance Record of Generator Protective Equipment

No. in Service	Equipment	Times Oper.	Operation Charged to Hr. in Service	Mfg. Defect	Protection	Year
8	Overspeed device.	8	40,892	8 (vibr.)	None	1928
		1	45,415	None	1	1929
		1	33,905	None	1	1930
8	Overvoltage relay device.	3	40,892	None	3	1928
		8	45,415	None	8	1929
		6	33,905	None	6	1930
8	Low governor oil-pressure relay device	4	40,892	None	4	1928
		1	45,415	None	1	1929
		None	33,905	None	None	1930
8	Phase unbalance relay device.	None	40,892	None	None	1928
		1	45,415	None	1	1929
		None	33,905	None	None	1930
8	Lignum vitae bearing cooling water relay	3	40,892	None	3	1928
		4	45,415	None	4	1929
		1	33,905	None	1	1930
24	Bearing temperature relay device	1	40,892	None	1	1928
		1	45,415	1 (vibr.)	None	1929
8		None	33,905	None	None	1930
8 each	Loss of generator field relays devices	1	40,892	None	1	1928
		None	45,415	None	None	1929
		None	33,905	None	None	1930
8	Generator ground relays device	5	40,892	None	5 (vibr.)	1928
		2	45,415	None	2	1929
		None	33,905	None	None	1930

There is a centralized supervisory control miniature switchboard located in about the center of the plant with a multi-conductor telephone cable between the miniature board and each generator control unit.

Aside from convenience and closer supervision there is another distinct advantage, namely, time is saved in performing operations when the plant is most needed and the item "human error" is controlled to a large extent. There is a considerable saving in labor cost, since only one operator is needed per shift, the yearly cost being 9,500 man-hours for three operators per 24 hours, including the relief operator. Apt young men of limited experience are entirely satisfactory for supervisory operators in this station.

The time saved in putting machines on the bus is especially important during system disturbances and it is possible, when urgently needed, to bring a 13,500-hp. hydro generator unit up to proper speed and put it on the bus in one minute. Additional units can be put on in approximately 30-second intervals thereafter.

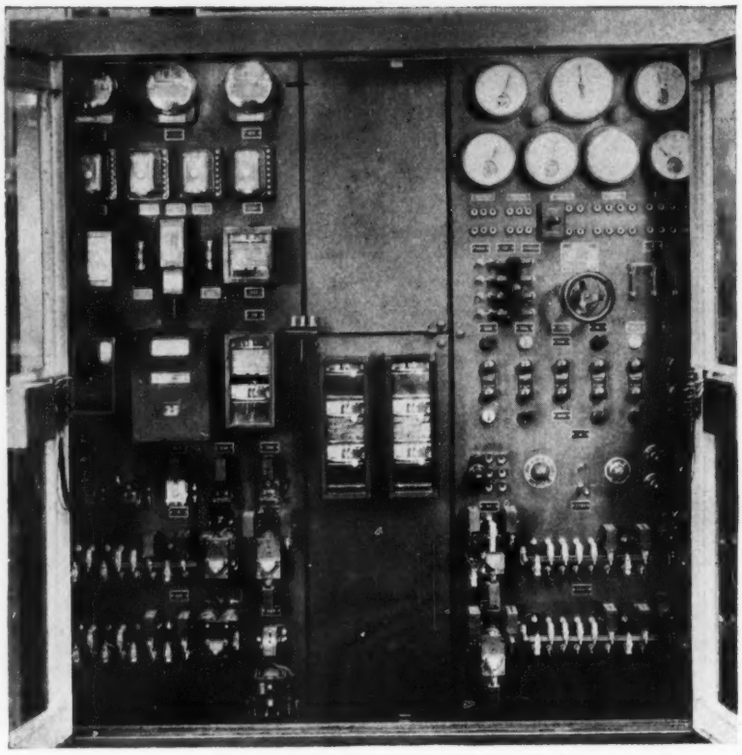
No more costly than standard board

The miniature board is no more costly to maintain than any other type of switchboard. In fact, a comparison of maintenance costs on a benchboard and vertical board with full-sized instruments, control switches, etc., at Waterside steam station indicates that the maintenance cost and inspection of the miniature switchboard and automatic equipment is less. With the exception of the instruments, the board is made up of equipment similar to telephone equipment. Multiconductor, lead-covered telephone cable is used to connect this miniature board with the individual control panels associated with each generator.

There is very little cleaning to be done, the equipment being inclosed in a practically dust-proof cabinet. There is some small maintenance of the board, such as cleaning control keys, contacts, etc., and renewing miniature lamps. The major portion of the technical service required has been in the nature of checking and testing out new equipment. In general, it may be said that once the equipment has been properly installed and adjusted it remains so without constant maintenance.

The automatic equipment is used extensively to replace manual operating duties. During 1928 (the first year the plant was operated) it was customary to test this equipment out completely every week because of the relative novelty of the installation. During 1929 tests were made monthly and now the equipment is tested only at intervals of three or four months when it appears to be necessary to clean the equipment.

Over a period of three years there have been no failures in the cable conductors. Each one of the multiconductor, lead-covered telephone cables has a few spare conductors so that failures can be taken care of readily and the system can be expanded if desired. Push-buttons used for control of load and voltage are similar in construction to telephone jacks; spring contacts complete the circuit to the generator cubicle, where small contactors operate to regulate frequency or voltage. Rotating type keys, similar to telephone equipment, are used for giving the starting impulse, for selecting the bus to which the generator is to be synchronized, either main or auxiliary, for selecting the method of synchronizing, either automatic or self, and for opening or closing oil circuit breakers.



Generator control board in steel cubicle

A few cases of trouble were experienced and traced to insufficient spring tension. Thereafter the spring tension was adjusted on all keys and no more failures have occurred. Three telephone lamps give the supervisory operator an indication of the position of the equipment—green for de-energized, red for energized, and white indicating that the position of the control key does not agree with the position of the equipment. Thus, during an outage, the green and white lamps appear, showing that the equipment has taken an open position. The supervisory operator then turns the control key to the open position, which extinguishes the white lamp, leaving the green lamp burning. Polarized relays receive the supervisory impulse originating from the rotating type keys on the miniature board. These keys, being two-position keys, give an energized signal or a de-energized signal to the polarized relays. The armature of the relay, in turn, moves to the energized or de-energized position. These relays function (1) to open or close the master control contactor; (2) complete the circuit for the method of synchronizing selected, either automatic or self; (3) give to the synchronizing equipment the control of the generator breaker selected, either main or auxiliary; also complete the circuit for lamp indication.

To date there have been five system disturbances which resulted in the hydro dropping load. Three cases were due to lightning flashing over on a 66-kv. tie line to the steam plant, one to lightning flashing over on a 13-kv. feeder which is connected to the city distribution system and one to failure of transformers stepping the voltage up to 66 and 138 kv. A very short time was required to get the units back into service and on the bus. These disturbances occurred before the generators were all equipped with self-synchronizing equipment and, therefore, in cases where the automatic synchronizing equipment did not function rapidly enough the operators put the machines on manually in order to save time.

Each disturbance caused a short circuit of considerable magnitude and, when the circuit breakers opened, the overspeed of the generators and consequent rise of voltage was such that the overvoltage protective relays operated, removing generators from the bus and shutting the units down. The bus being dead, the station

Table III—Maintenance for Three-Year Period

Use	Equipment	Maintenance	Man-Hours
Automatic control of governor oil pressure system	Gage type relays and automatic compensator controlling oil pressure	Cleaning and adjusting contacts	850
Interlocking pneumatic brakes on generator and main oil circuit breakers	Unit brake valve solenoid	Periodic inspection and cleaning	216
Controlling 66-kv. power transformer banks	Transformer bank cubicle recording meters with Selsyn attachment. r.kva., kw., kv.; automatic synchronous equipment	Calibration, changing charts. Detail changes	518
To shut unit down in case of trouble on unit	Bearing thermal relays; water-flow indicator; ground relay; overspeed device; phase unbalance relays; loss of generator field relays; governor low-oil pressure relay	Monthly inspection, cleaning, adjusting, etc.	972
Automatic control of generator equipment	Contactors in generator cubicles	Inspection, cleaning, etc., replacing burned-out coils; changing and simplifying control circuit	450
Control of generator and transformer cubicles from miniature supply switchboard	Miniature switchboard 39 rotary control keys	One inspection each control panel; removed from cabinet; contacts and spring tensions adjusted	50
	Miniature switchboard 32 push-button control switches	Periodic inspection, cleaning and testing proper spring tension	20
	111 miniature indicating lamps (24 volt)	Replacing 50 lamps, inspection and cleaning	27
	Miniature instruments on miniature switchboard indicating kv., kw., r.kva	Adjustment of bearing friction; replacement of defective spring on one meter and recalibration	45
Indicating total kw., r.kva. and kv on 66-kv. power transfer bank	Selsyn control meters on miniature board	Periodic inspection and cleaning	25
Various contactors dependent on polarized relays to energize master circuit to start unit; select proper bus; select method of synchronizing	Polarized relays on cubicles: 78 for eight generators; 2 for 66-kv. transfer bank; 3 for station auxiliary bank	Cleaning, adjusting, etc. Replacing a few coils	165

light and power bank was automatically transferred to the incoming emergency line. It is to be noted that a maximum time of four minutes was required to get the last generator in on the bus in the case of the first two disturbances when, in the first case, eight generators were running and, in the second case, five generators were running. In restoring service, the supervisory operator closes the tie line in on one 13-kv. bus. Thereafter, the starting impulse is given to all generators, automatic means of synchronizing having previously been selected at the miniature supervisory board. As it was necessary to get generators on the bus as soon as possible, it was therefore customary—previous to the time all units were equipped for self-synchronizing, if the automatic synchronizing equipment had not synchronized the generator promptly enough—for a floor operator to go to each generator cubicle and do so manually. Now that this equipment for self-synchronizing is installed for all generators, and since this method is much quicker, it is being used almost entirely.

▼ ▼ ▼

Generator Voltage Regulated by Corona Tube*

By H. W. DODGE and C. H. WILLIS

New Jersey Bell Telephone Company and Princeton University, Respectively

ALMOST any phenomenon which varies with voltage may be made the basis of a voltage regulator, such as the saturation of an iron cored reactor, the resistance of a conductor heated by the voltage, or the internal resistance of a thermionic tube whose filament is heated by the voltage. The regulator described below employs the critical voltage of a corona tube as the basic phenomenon. This type of regulator would employ the same methods of compounding and line drop compensation now in use. It is believed that the simplicity, compactness, high sensitivity and quick response of this regulator offer advantages over the other types.

The corona discharge tube employed consists of two symmetrical electrodes sealed into a glass tube containing an inert gas at a suitable pressure. Due to the fact that the tube contains a definite quantity of gas constrained to a fixed volume, the mean free path of an ion and therefore the corona voltage are practically independent of the temperature. Since ionization builds up very quickly at a voltage above the critical value, the breakdown voltage is also independent of the frequency for frequencies within the commercial range. With the electrodes surrounded by an inert gas such as argon there is negligible disintegration of the electrodes during discharge; the breakdown voltage of the tube is constant and the life very long.

These characteristics of the corona discharge tube make its critical voltage suitable for the constant element in a regulator. The fact that it regulates to a constant peak voltage rather than a constant effective voltage is not a serious disadvantage, for the variation of wave form with load is not appreciable and there will therefore be a constant form factor.

In order to control the excitation of a generator we may use the charge passing through the corona tube above the corona voltage to bias the grid of a rectifying tube and thereby regulate the amount of rectified current which will be supplied to the generator field. Any type of rectifying tube may be used. However, the high efficiency and large amplification factor of a gaseous tube, such as the "Thyratron," make this type of tube very desirable.

Thyratron and full-wave rectifier used

A thyratron with a negative grid characteristic normally conducts current into the field of the generator during the half wave when the anode voltage is positive. During the half wave when the anode voltage is negative the condenser *C* will be charged provided the circuit is connected with the proper polarity and provided the voltage rises above the critical value for the corona tube. During the first part of the next positive half wave the thyratron cannot conduct current because the grid is negative. However, the grid bias will be reversed by the corona tube at the peak of the voltage wave and the thyratron will conduct current during the latter half of the positive voltage wave as shown by the cross-hatched area. In this way the average value of the rectified current will be reduced to one-half the full half wave or maximum value when the voltage is above the breakdown value for the corona tube.

If a voltage is impressed on the corona tube which lags in phase behind the rectifier voltage the average current may be reduced to less than 50 per cent of its maximum value because the grid bias will then be reversed after the peak of the voltage wave. When the corona tube is supplied from a voltage 60 deg. behind

**Abstract of paper presented at A.I.E.E. summer convention, Asheville, N. C., June 25, 1931.*

Fig. 1—Thyratron characteristics and condenser charge are basis of regulator

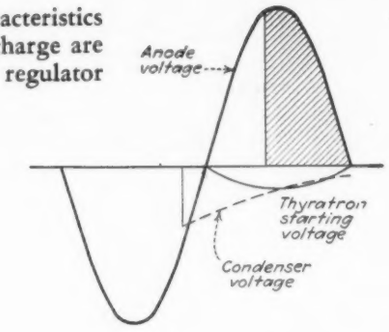


Fig. 2—Arrangement of thyratrons, condenser leaks and corona tube

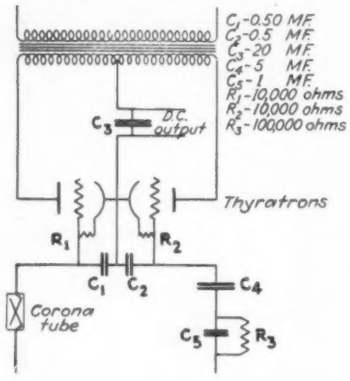


Fig. 3—(below, center) Voltage independent of load

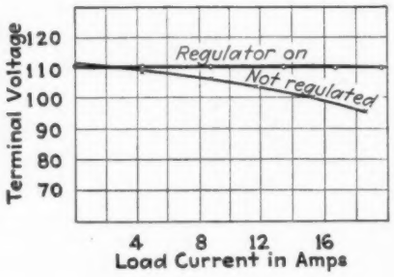
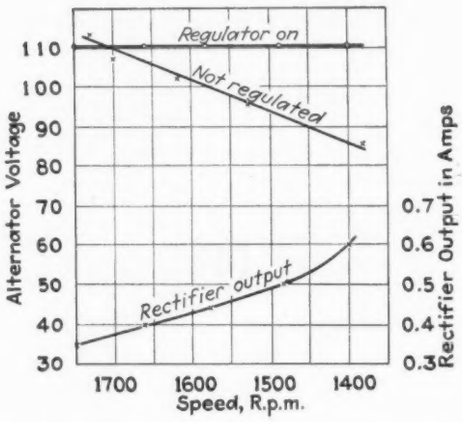


Fig. 4—Generator voltage independent of exciter speed

Tests made on a 5-kva., three-phase alternator and 110-volt motor-driven exciter.



the rectifier voltage, as in a three-phase machine, the corona tube will reduce the average current to 7 per cent of the maximum value.

Acts like vibrating type of regulator

The circuit as described above will vary the excitation by definite steps and will give fluctuations in the excitation just as are produced by opening and closing the contacts of a vibrating regulator. However, if a leak is placed across the grid biasing condenser of a value such that the time constant $C\ R$ of this condenser and leak is about equal to the period of one half wave, then the grid condenser voltage may be reduced by leakage to a value where the thyratron will start. The time it will take to reduce the grid voltage to the starting value will depend on the initial charge of the grid condenser, and this is determined by the excess of the voltage above the critical voltage of the corona tube. Therefore the time of starting for the thyratron rectifier in any half wave will be delayed by an amount which is determined by the excess of the voltage above the breakdown voltage of the corona tube. A small rise in total voltage above the critical value will serve to reduce the rectified current to about 7 per cent of its maximum value. However, this change is continuous.

Fig. 2 shows the circuit used for controlling a full-wave rectifier by means of a corona tube. It was found quite difficult to make corona tubes so symmetrical that they would break down at the same voltage on the positive and negative half waves. However by adding the condenser C_4 shown in Fig. 2 it is possible to eliminate any unidirectional components of current and cause the corona tube to have the same positive and negative critical values.

In the regulator used for the results given below the thyratrons were too small to rectify the entire field current and their output was therefore used for the field of an exciter.

In this case a further difficulty arose in the time lag of the exciter and alternator fields in responding to a change in the rectifier output. This caused oscillations of the generator voltage of about the period of the time constant of the field circuit. It was found possible to suppress these oscillations by introducing into the corona tube circuit a transient of about the same period as the oscillations. This transient is introduced by a condenser with a leak as shown at C_5 and R_3 of Fig. 2, such that $C_5\ R_3$, the time constant, is about equal to L/R, the time constant of the slowest field circuit.

The critical voltage of a corona tube with given dimensions and gas pressure may be predicted from the data giving the corona voltage of the gas to be used. The tube as used contained argon at a pressure of 2 cm. of mercury. The electrodes were parallel wires 0.25 mm. in diameter and separated 1 cm. The critical voltage of this tube was approximately 350 volts peak value.

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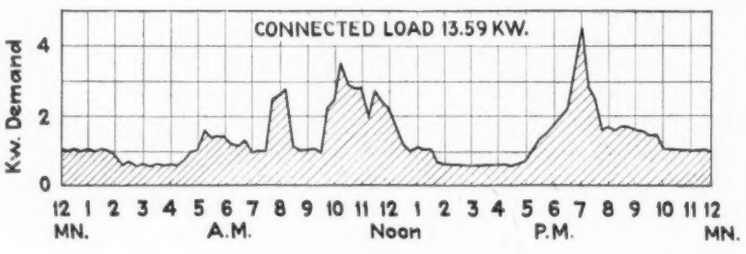
Daily Load Curve of an All-Electric Home

The home which had this daily load curve on April 22, 1931, contained 13,590 watts of connected load, consisting of 7,300-watt range, 2,000-watt water heater, 1,200-watt ironer, 625-watt toaster and space heater, 660-watt waffle iron, 580-watt hand iron, 340-watt clothes washer and 260-watt refrigerator. Between April 21 and May 1, 298 kw-hr. was used. The highest fifteen-minute demand was 4.5 kw. and the load factor was 27.8 per cent. This home is located in Hyde Park, N. Y., on the system of the Central Hudson Gas & Electric Corporation.



Cable Insulation Thickness Can Be Reduced*

By D. W. ROPER

Superintendent Street Department, Commonwealth Edison Company, Chicago, Ill.

IT IS generally recognized that the installation of 132-kv. oil-filled cable in 1927 was the culmination of an epoch-making improvement in high-voltage cable. It is not so generally appreciated, however, that the later developments, when completely assembled and properly combined, result in an economic advancement of the same order of importance. This is particularly true for the larger sizes, for which the annual charges have been reduced by more than 50 per cent.

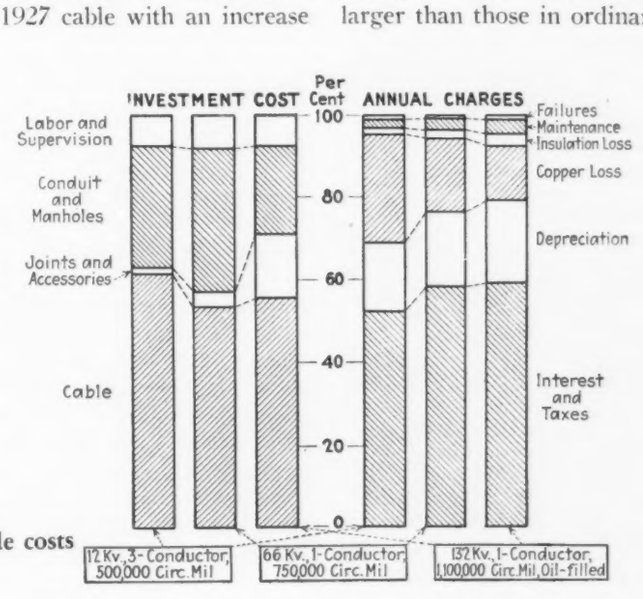
No single one of these developments has been spectacular. Some of them, in fact, when taken by themselves appear quite insignificant, as, for example, the development of a suitable oil with a flow point of about minus 40 deg. C., as compared with a flow point of about minus 15 deg. C. for the oil used in the first line. This thinner oil permits a lower normal pressure on the oil within the cable without allowing the internal pressure to be reduced below atmospheric under the most adverse operating condition; that is, when the load is suddenly interrupted at a time that the cable is at maximum temperature with the ambient temperature at a minimum. This lower pressure, in turn, permits the use of a single lead sheath in place of the double reinforced sheath used in the first line, thus making more space available for the conductor, and so the 1930 cable has a conductor 83 per cent larger than the 1927 cable with an increase in over-all diameter less than 3 per cent.

But there was no commercial advantage in increasing the size of the conductor unless the sheath losses could be eliminated. The experience in Chicago with the methods and devices for eliminating sheath losses on 12-kv. and 66-kv. cable furnished the background on which the decision was made to extend the use of similar methods to oil-filled cable. The new type of oil, together with improved designs of oil tanks, permitted a very marked simplification of the design and reduction in the cost of the terminals and the development of methods of making joints in the field between sections of cable filled with oil and the shipping of the cable full of oil eliminated the expensive field evacuation and impregnation methods that were necessary with the first line.

The economic effect of these developments became apparent while designing the line installed in 1930. About the same time a number of other questions arose in connection with the development of the transmission system in the Chicago region, such as the maximum economical size for 132-kv. cable, the feasibility of 220-kv. cable and the economics of the use of oil-filled cable for 60-kv. or lower voltages. Some preliminary studies had indicated that the most economical cable for a given set of conditions would be determined by the annual charges rather than by the first cost, and this led to the decision to extend the investigations in progress so as to cover the entire range of transmission voltages. Cable manufacturers were of great assistance in furnishing estimating prices for oil-filled cables.

66-kv. cable in the twilight zone

In order to determine the most economical size for a number of the voltages, it was necessary to continue the calculations so as to include sizes of cable and ducts larger than those in ordinary use. The resulting curves show that for each load there is one type of cable and one operating voltage which is more economical than any other combination. Three-conductor cables are the most economical for loads up to about 50,000 kva. and the newly developed 66-kv., 3-conductor, oil-filled cable has the advantage over the upper half of this range. Beyond 50,000 kva. per line single-conductor cable is more economical, but at the unit prices used for these calculations oil-filled cable does not become more ad-



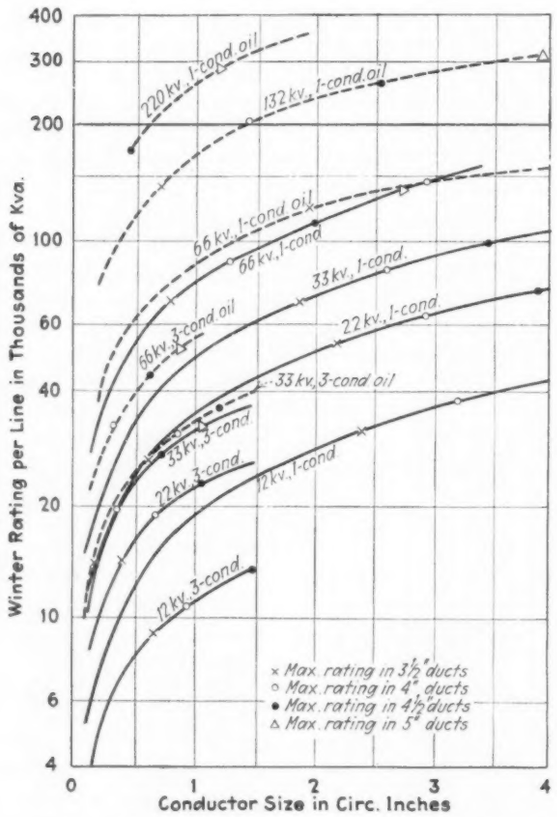
Breaking down cable costs

**Abstract of paper presented at A.I.E.E. summer convention, Asheville, N. C., June 25, 1931.*

vantageous than the ordinary type until a load of about 120,000 kva. for a 132-kv. line is reached. For 66-kv. operation a reduction of about 15 per cent in the price of oil-filled cable and about 30 per cent in the cost of the accessories would, however, make the oil-filled type more economical than the ordinary type of insulation for practically the entire range for which the ordinary type of single-conductor, 66-kv. cable is now more advantageous.

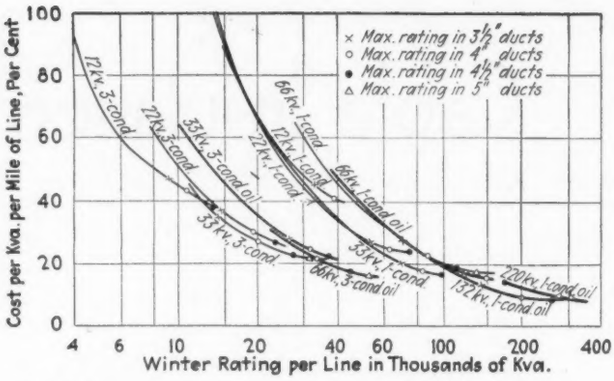
A reduction in the thickness of insulation for 66-kv. cable of the ordinary type now required by American manufacturers would alter this situation. Whether the use of oil-filled cable will be extended to 66-kv. and lower voltages, or whether the use of the ordinary type of insulation will be extended to 132-kv. within the next few years will depend upon the relative rate of improvement of the two types of cable with unrestricted competition. At this time neither of these developments appears impossible.

Investigations indicate that the most promising way to reduce the annual charges for underground transmission lines is to reduce the first cost of the line as installed. Not much advance can be made along this line without a reduction in the thickness of insulation. Progress in this direction depends upon the development of tests satisfactory to both manufacturers and purchasers which will indicate beyond any reasonable doubt that a lesser thickness will be entirely suitable for the purpose. Co-operative studies with certain of the cable manufacturers have been carried on in Chicago with this idea in view for the past four years. The most promising criterion for the purpose appears to be the determination of the maximum stress and temperature at which the insulation can be operated without signs of instability. Limits of time and space will permit only the presentation of some of the more interesting results of such tests.


Winter Rating per Line in Thousands of Kva.
Conductor Size in Circ. Inches
220 kv., 1-cond. oil
132 kv., 1-cond. oil
66 kv., 1-cond. oil
66 kv., 1-cond.
33 kv., 1-cond.
66 kv., 3-cond. oil
22 kv., 1-cond.
33 kv., 3-cond. oil
33 kv., 3-cond.
22 kv., 3-cond.
12 kv., 1-cond.
12 kv., 3-cond.
× Max. rating in 3½" ducts
○ Max. rating in 4" ducts
● Max. rating in 4½" ducts
△ Max. rating in 5" ducts

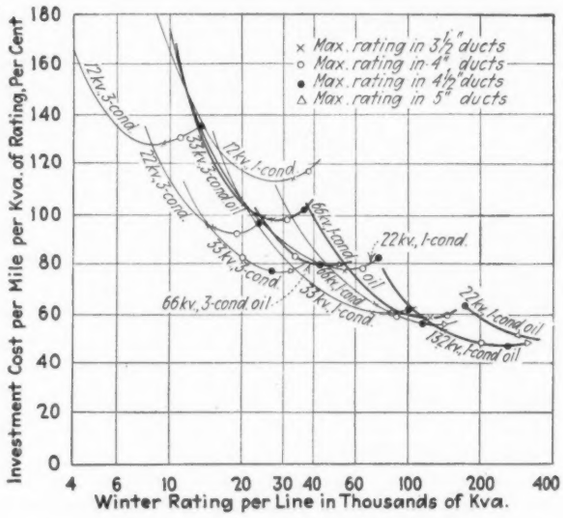
Ratings affected by type of cable and number of conductors

No sheath losses included for single-conductor cables. Cable diameter not more than five-sixth of duct diameter.


Cost per Kva. per Mile of Line, Per Cent
Winter Rating per Line in Thousands of Kva.
× Max. rating in 3½" ducts
○ Max. rating in 4" ducts
● Max. rating in 4½" ducts
△ Max. rating in 5" ducts
12 kv., 3-cond.
22 kv., 3-cond.
33 kv., 3-cond. oil
66 kv., 1-cond.
12 kv., 1-cond.
22 kv., 1-cond.
33 kv., 3-cond.
66 kv., 1-cond. oil
33 kv., 1-cond.
66 kv., 3-cond. oil
132 kv., 1-cond. oil
220 kv., 1-cond. oil

Conduit and manhole costs relatively high for 12 kv.

One cable per duct; 100 per cent on cost scale is minimum cost of 12-kv. cable itself installed in conduit.


Investment Cost per Mile per Kva. of Rating, Per Cent
Winter Rating per Line in Thousands of Kva.
× Max. rating in 3½" ducts
○ Max. rating in 4" ducts
● Max. rating in 4½" ducts
△ Max. rating in 5" ducts
12 kv., 3-cond.
22 kv., 3-cond.
33 kv., 3-cond. oil
12 kv., 1-cond.
66 kv., 1-cond. oil
22 kv., 1-cond.
33 kv., 3-cond.
66 kv., 3-cond. oil
33 kv., 1-cond.
66 kv., 1-cond.
132 kv., 1-cond. oil
220 kv., 1-cond. oil

First costs of 10-mile cable lines

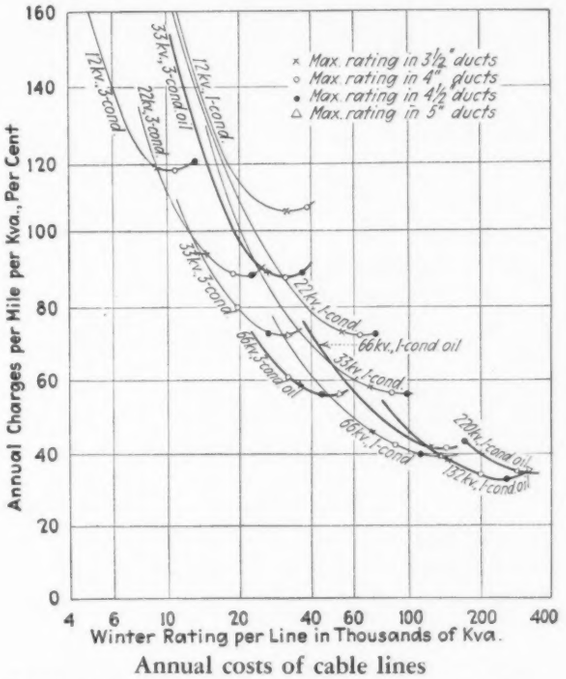
Terminals included; 100 per cent on cost scale is minimum cost of 12-kv., three-conductor cable exclusive of terminals.

Cables with ordinary and oil-filled insulation made about five years ago show continually changing power-factor curves for the ordinary insulation, but a remarkable stability of the oil-filled type. These results, together with the perfect operating record of the oil-filled insulation, indicate that the commercial cables had more insulation than necessary. As it was not feasible to make long-time tests on the same cable with gradually increasing voltages, cable manufacturers submitted for further tests several 1,000-ft. lengths of oil-filled cable with reduced thickness of insulation. Tests on these oil-filled cables with insulation of about 0.5 and 0.4 in. show not only a very remarkable stability after eight months' operation with daily load cycles, but also a curious improvement in the quality of the insulation of the reduced thicknesses. Apparently the limit of neither electrical stress nor temperature has been reached with these investigations of oil-filled insulation.

Investigations on insulation of the ordinary type, which are still in progress, indicate that certain recently made

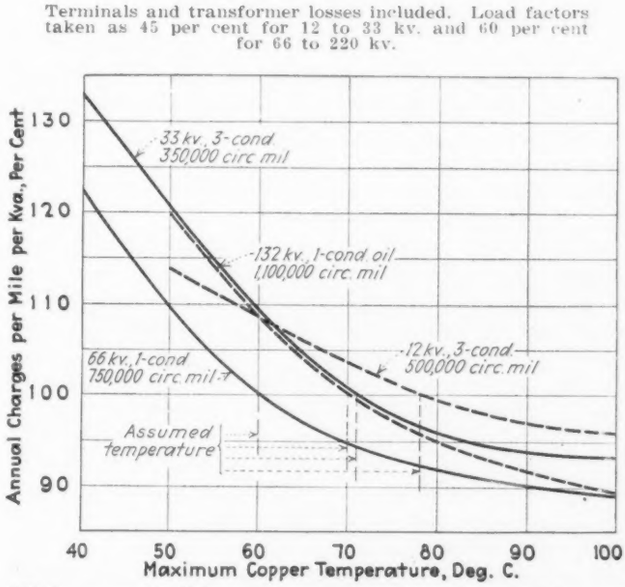
cable is very much better than the cables originally installed for the experimental investigation. Apparently some of the cable furnished for commercial service at 66 kv. will almost comply with the requirements suggested several years ago by the manufacturers to determine the suitability of cable for 132 kv. This would indicate the possibility of making a marked reduction in the thickness of insulation for 66-kv. service.

When all the research investigations now in progress by the manufacturers and users of high-voltage cable have been carried to a successful conclusion the maximum temperature will not be determined by the insulation nor by fear of stretching the lead sheath, but by the effect of the increased loading on the annual charges. Means will be devised for eliminating the expensive oil reservoirs and accessories now required with oil-filled cable with a consequent reduction in the price. The initial cost of 66-kv. cable completely installed will be from 30 to 40 per cent below the present cost of the ordinary type and the failures due to all causes will not exceed one failure per hundred miles per year.


Annual Charges per Mile per Kva., Per Cent
Winter Rating per Line in Thousands of Kva.
× Max. rating in 3½" ducts
○ Max. rating in 4" ducts
• Max. rating in 4½ ducts
△ Max. rating in 5" ducts
12 kv., 3-cond
33 kv., 3-cond oil
22 kv., 3-cond
12 kv., 1-cond
33 kv., 3-cond
22 kv., 1-cond
66 kv., 1-cond oil
66 kv., 3-cond oil
33 kv., 1-cond
66 kv., 1-cond
220 kv., 1-cond oil
132 kv., 1-cond oil

Annual costs of cable lines

Terminals and transformer losses included. Load factors taken as 45 per cent for 12 to 33 kv. and 60 per cent for 66 to 220 kv.


Annual Charges per Mile per Kva., Per Cent
Maximum Copper Temperature, Deg. C.
33 kv., 3-cond 350,000 circ. mil
132 kv., 1-cond oil 1,100,000 circ. mil
66 kv., 1-cond 750,000 circ. mil
12 kv., 3-cond 500,000 circ. mil
Assumed temperature

Higher permissible temperatures reduce annual charges

Oil-filled cable is being operated at stresses between two and three times that which is customary for insulation of the ordinary type. Prospective purchasers of such cable must improve their standards of design, workmanship, maintenance and supervision to at least the same extent in order that they may be able to benefit from the improvements which have been made and will be made by the cable manufacturers.

Looking forward

When all the research investigations now in progress or contemplated by the utilities, universities and manufacturers have been brought to a successful conclusion:

1. Cables of all types and voltages will be operated at a maximum temperature of 85 to 90 deg. C.
2. The expensive oil reservoirs and accessories on oil-filled cable will be eliminated due to:
   (a) Increase in the elastic limit of the cable sheath.
   (b) Reduction in the thermal coefficient of expansion of the oil.
   (c) Making the insulation somewhat compressible under moderate pressures existing with the lead sheath.
3. An installation of oil-filled cable will be no more complicated than a present-day installation of ordinary type of cable.
4. Cable of subnormal quality will be eliminated by tests at the factory.
5. The initial cost per kva. of 66-kv. cable completely installed will be from 30 to 40 per cent below the present cost of the ordinary type.
6. Cable failures due to all causes will not exceed one per hundred miles per year.

If all of these results should be achieved within the next fifteen years, it would be no more startling than a statement of the present-day state of the art would have appeared fifteen years ago.

In order that the utilities may realize the benefits of such improvements in quality of cable, their standards of design and construction of conduits and manholes, workmanship during installation and splicing, as well as the standards of operation, inspection and maintenance, must be increased in at least the same ratio as the improvement in insulation.

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Cable Reels Hoisted by Derrick

The average length of the cables between the sub-basement splice chamber and the 41st floor chamber in the Empire State Building in New York City was 565 ft. and the cables between the 41st and 84th floors averaged 620 ft. Considering the cable size and weight, the cable reels were large and bulky, which presented a handling problem unusual in electrical work in commercial buildings. Consequently the steel-erection derricks were used to hoist the reels up along the outside of the building to the 41st floor. Material hoists were used to lift those which were destined for the 84th floor. Actual installation of the cables involved dropping them into the conduits from the respective splice chambers. The problem was principally one of holding the cable securely in check so that it entered the conduit slowly at a uniform rate and with an adequate radius of sweep.

Differential-Bus Protection Proves Its Merit

By H. H. COX

Superintendent Receiving Substations, Department of Water and Power, Los Angeles, Calif.

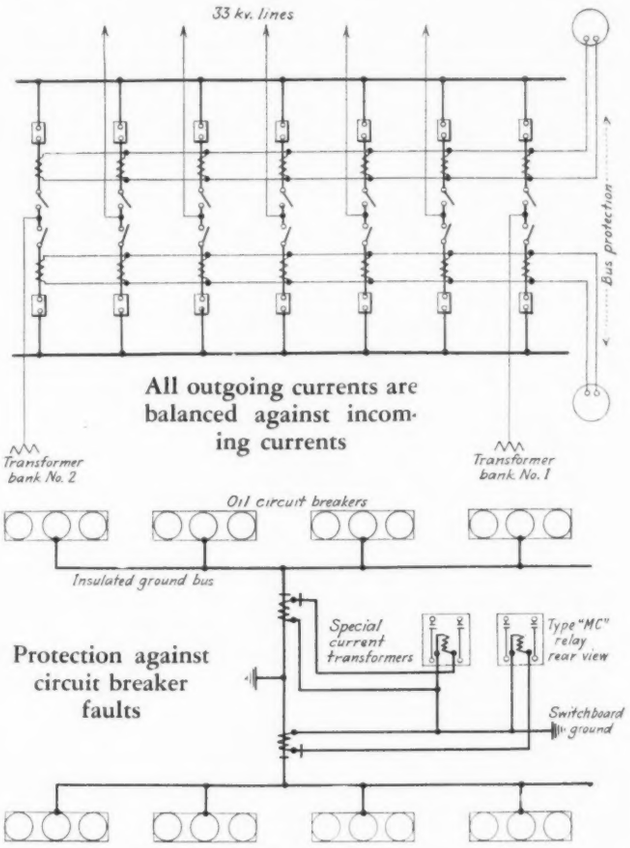
Failures which involve station buses are generally of two types—one in which some insulator flashes over from lightning or some apparatus fails and the other where some human error is involved. Inasmuch as station bus failures are always of a serious nature, involving damage to essential apparatus and in many cases the probability of serious personnel injuries, it early was realized by engineers of the Department of Water and Power of the city of Los Angeles that some form of bus protection was essential. An original scheme of differential bus protection was proposed by the writer for this purpose which involved the connecting in parallel of as many current transformer secondaries as there were connections to the bus in question. This scheme required use of similar current transformers in all positions and is shown in the accompanying diagram. It is operative on the theory that the vector sum of all currents entering the bus must be equaled by the vector sum of all currents leaving the bus, and so long as no fault exists on the bus there will be no current flowing through the relays.

When first proposed it was thought that current transformer errors and the failure of current transformer ratios under overload conditions would render the scheme inoperative. Accordingly, it was put through a thorough set of laboratory tests under the supervision of the protection engineer, using the maximum amounts of current available, and from this it appeared that the current transformer ratio errors were self-correcting and that incorrect operation would not be experienced from this cause. Following the tests, two stations on the system were equipped with this type of protection.

The department's stations are particularly adapted to this form of protection as they are equipped with two buses and a complete set of oil circuit breakers to each bus. After a number of through short circuits had definitely proved that nothing was to be feared from this source, it was adopted and has since been applied generally to all stations. To date there have been in excess of 100 cases of through short circuits on various overhead and underground lines and there has been no case of incorrect operation of the bus protection from any cause.

Normal operating conditions on this system involve both buses in service and all oil circuit breakers closed. This condition holds except when a bus or bus section is out on a clearance. To date there have been ten cases of bus trouble from insulator flashover, by lightning or by apparatus failure. In every case where both buses have been in service the bus protection relays have cleared the trouble properly and left the station in operation on the other bus with only a momentary drop in voltage. There have been three cases of bus trouble from human causes. In two of these the bus was cleared and the station load carried with only momentary drop in voltage. In the third case the other bus was not in service and hence the station load was interrupted. In every case the relays have cleared the bus properly, have minimized the damage and have saved the life of the individual workman concerned. In two cases workmen contacted the live 33-kv. or 6.6-kv. buses with construction material and escaped with only minor superficial burns.

The cost of installing differential-bus protection is not excessive. The principal items are the three bushing type current transformers per circuit breaker involved and one set of three main relays, together with the necessary auxiliary relays, per bus. While this cost is possibly somewhat more than that of a fault ground bus installation, it is felt that it gives greater protection. Fault ground bus protection, as shown by the accompanying sketch, is used in certain of the department's



receiving stations in addition to the differential protection, but its application covers only those failures through flashover to the oil circuit breaker framework. Failure of a bus insulator is to the building steel and it was not considered desirable to extend the fault ground bus to cover flashovers of this character.

From experience gained with the many forms of relay protection on the municipal system engineers of the Department of Water and Power reached the conclusion that every unit of an electrical power system should be protected by some form of relay protecton for rapid clearing of the unit in question for the limitation of damage to apparatus, the protection of human life and the minimizing of interruptions to service, and that somewhere in the system there should be a second line of defense which will clear a case of trouble on any particular apparatus by clearing a larger group of lines and equipment if the primary relay protection should fail. The Department of Water and Power system is now generally equipped in accordance with these conclusions

225 Miles of 132-Kv. Line Erected in 225 Days

By R. H. HALPENNY
Electrical Engineer Southern Sierras Power Company

Across 225 miles of desert and mountains, the 132-kv. transmission line to serve Hoover Dam construction activities was built in 225 days by the Southern Sierras Power Company and was ready to deliver power on June 13. The 15,000-kva. terminal substation was constructed during the same time at a site on the canyon rim within 700 ft. of the Nevada abutment of the dam, using a temporary construction road with 17 per cent grades. The line was designed to permit its use for transmitting power back into the company's system when the plant at the dam is placed in operation.

Three days after the signing of the contract survey parties were in the field for final location of the line, which had already been established as to general route. Right-of-way difficulties were not serious, much of the line traversing publicly owned desert and mountainous land. Within six weeks crews had begun excavation for bases and the first consignment of steel had been received.

Construction programming included the establishment of eight material depots with temporary warehouses at points on the railroad along the route of the transmission line. Material was dispatched from these warehouses to the field by trucks in scheduled deliveries timed to maintain a proper flow of supplies and equipment to erecting crews.

Because the material for the towers included many small pieces that were essential for uninterrupted erection procedure, special attention was given to the preparation of the steel for shipment. The shipper was required to bundle all tower members in such a way that a complete structure was contained in a certain number of bundles so that breaking of bundles during field distribution with possibility of losing essential parts was avoided.

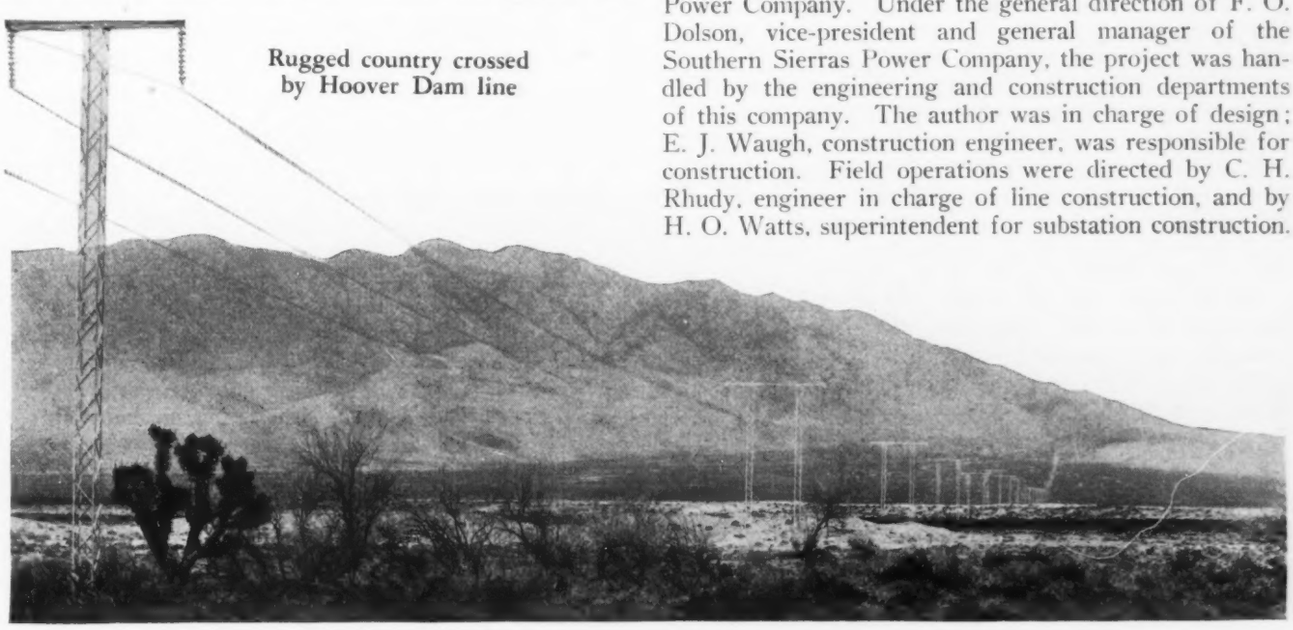
No roads existed along much of the route. Difficulties were not serious in breaking new roads on the desert sections, but across the mountains the transportation of construction materials taxed the skill of those handling this work. In one section it was necessary to use a truck equipped with winch and cable to negotiate the steep downgrades. The summit could be reached by existing road, and here the end of the half-mile length of cable was attached to a tree and the truck let down the mountainside. Then the cable was reeled in and the process repeated until the grade allowed the truck to continue under its regular brakes.

Field camps of 50-man capacity (occasionally expanded for 80) were provided for construction crews. As many as five of these camps were in operation at one time. Every effort was made to provide comfortable accommodations and adequate commissary. Canvas floors in the tents were an aid to cleanliness and were a protection from various forms of desert life. Use of gas from high-pressure tanks for cooking and for heating tents solved the fuel problem and decreased the fire hazard. Although it was possible in most instances to locate camps where water was available, some sites required a water haul of 20 miles.

One of the camps was used as a field headquarters for the direction of construction operations, which at times extended for 125 miles along the line. Records were maintained so that at the close of each day it was possible to tell exactly the work accomplished during the past 24 hours. These results were transferred to graphic charts maintained both at field headquarters and in the office of the construction engineer at the company office.

Field organization involved the use of construction units handling separate divisions of the work, such as hole digging, base setting, steel erecting and conductor stringing. Under this plan two or more units worked out of a camp which was maintained until that section of the line had been completed.

The contract for furnishing power for Hoover Dam construction activity is held jointly by the Southern Sierras Power Company and the Nevada-California Power Company. Under the general direction of F. O. Dolson, vice-president and general manager of the Southern Sierras Power Company, the project was handled by the engineering and construction departments of this company. The author was in charge of design; E. J. Waugh, construction engineer, was responsible for construction. Field operations were directed by C. H. Rhudy, engineer in charge of line construction, and by H. O. Watts, superintendent for substation construction.



Rugged country crossed by Hoover Dam line

READERS' FORUM

Wants Additional Information on Merchandising Practices

To the Editor of the ELECTRICAL WORLD:

Your May 30 issue, containing "Utility Merchandising Achievements and Policies—1930," embodies a lot of valuable information. But a casual reading fails to reveal a study of two very important facts:

First—How many of these companies use general sales organizations and how many have their sales organizations set up on a more or less specialized basis? How many of them have special range salesmen? How many of them have special refrigerator salesmen? Of course, the use of a special sales crew on any one appliance might be uneconomical in territories where customers are scattered, such as in the Southeast and Northwest, but it would be interesting to compare the success of companies having specialized sales organizations with those having general sales organizations, especially in metropolitan centers.

Second—Another basic question, and to my mind one of the most important, is what provisions do the public utilities make for the training of their salesmen? Do they leave it to the manufacturers and, if so, how much time do they give the manufacturers prior to a special sales effort to train their men? What provisions do they make for the training of their men between special sales periods, in order to take care of the turnover which takes place. What is the average turnover of public utility salesmen and what methods and suggestions are there for reducing this turnover and, thus, making the average efficiency per man higher?

MARSHALL ADAMS,

Sales Promotion Manager, Merchandising Department, Westinghouse Electric & Manufacturing Company, Mansfield, Ohio.

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A Visitor from Buenos Aires Looks at Our Research Laboratories

To the Editor of the ELECTRICAL WORLD:

I have just attended the N.E.L.A. convention at Atlantic City as a guest of a leading American manufacturing organization, and as a result of what I saw and heard in that marvelous convention hall I have come to realize how little the American public—and this is even more true of foreign countries—realizes the true significance of what the electrical industry has done for the welfare of humanity in general.

What has impressed me more profoundly than anything else is the remarkable idealistic spirit of your large industrial corporations devoted to the electrical industry in this so-called materialistic age. These great corporations, regarded by the average individual merely as soulless trusts and a potential menace to society, have nevertheless, by reason of their constant growth and diversity of activities, been able to support wonderful research laboratories where the spirit of commercialism is singularly absent. In other words, these great enterprises have succeeded in combining the two diverse factors, materialism and idealism, with such efficiency that they tend to create ideal conditions. In them the scientific minds of the whole world are invited to satisfy their innate hunger for pure scientific research and receive undreamed-of facilities and financial support without any definite return, in time or results, being demanded of them.

What seems most extraordinary is the fact that these remarkable conditions are co-existent in an environment where materialism is most highly developed, and yet the two influences are so well combined that the most outstanding scientific and electrical developments of our age have been the product of these American laboratories.

ERNESTO LIX-KLETT,

President E. Lix-Klett & Company, Consulting Engineers, Buenos Aires, Argentina.

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Cautious Use of Special Bus Arrangement

To the Editor of the ELECTRICAL WORLD:

The article by John Auchincloss in the ELECTRICAL WORLD of April 4 shows a somewhat unusual arrangement of a transfer bus. The writer would like to point out one caution in using this arrangement—that is, it is not possible to take the current transformers out of service without clearing the feeder circuit.

In many cases we have found that the current transformers and associated equipment give more trouble than the circuit breaker, and for this reason we have frequently asked that the metering equipment be adjacent to the breaker and be capable of isolation and by-passing. This is particularly true of relay trouble, control trouble, metering difficulties, etc.

While the suggested scheme has much merit, each case should be considered individually to see whether or not the current transformers should go with the line or the breaker.

E. E. GEORGE,
Electrical Engineer.

Tennessee Electric Power Company, Chattanooga, Tenn.

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That Texas Lightning Picture

To the Editor of the ELECTRICAL WORLD:

I have just been reading Chas. Fortescue's comment on page 334 of the ELECTRICAL WORLD, February 14, 1931, in regard to the picture "Does Lightning Look Like This from Above?" published in ELECTRICAL WORLD, January 10, 1931, page 84.

I disagree with Mr. Fortescue's question as to the validity of this photograph because I studied the rotogravure print of the original photograph last summer, sent to me from one of the Chicago papers.

The view is rather exceptional as it was taken from a high elevation, but I have seen this phenomenon several times from the ground from the side and it appears as a witch's broom. The individual streamers progress away from the main lightning discharge at a speed of about 30 miles a second and such a discharge may last upward of a second. The aviator was undoubtedly a considerable distance from the main lightning stroke, which is probably concealed by the body of the cloud in the reproduction of January 10, and was within what might be termed the funnel of the feeding discharges forming the rays and which undoubtedly were following over the general surface of a cloud.

D. D. CLARKE,
Consulting Electrical Engineer.

Kansas City Power & Light Company, Kansas City, Mo.

BOOK REVIEWS

Policy and Ethics in Business

By C. F. Taeusch. McGraw-Hill Book Company, Inc., New York. 624 pages. Price, $5.

After developing the social and philosophical backgrounds for business conduct, the author deals with specific aspects of business activity such as the Sherman law, legitimate trade channels, prices, competitive bids and trade associations. The book stands out for its depth of treatment from the philosophical and psychological point of view. It is not a business manual written in the ordinary jargon of business, but develops the policy and ethics of business conduct in terms of particular applications and their social and legal significance. It is a splendid book for every business man to read.

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The Theory and Design of Illuminating Engineering Equipment

By L. B. W. Jolley, J. M. Waldram, G. H. Wilson. John Wiley & Sons, New York. 709 pages, illustrated. Price, $12.

This book treats largely of the design of lighting equipment, yet adds chapters on fundamentals of light to make a very complete treatise on illumination and fixtures. It ranges through all types of interior and exterior lighting fixtures and projectors and gives a quantitative discussion of fixture design and performance.

Physiological principles of light, methods of light calculation, the physics of light production, lamps, arc lamps, gaseous conduction lamps, interior lighting equipment, street lighting, floodlighting, window lighting, design of lighting equipment, reflecting equipment, diffusing media, projection systems, color-diffusing media, signs and other topics indicate the completeness of the treatment. It should be useful to illuminating engineers and makers of lighting equipment.

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Electrical Drafting and Design

By C. C. Bishop. McGraw-Hill Book Company, New York. 190 pages, illustrated. Price, $2.

This is a text developed for technical high school students. In a brief but complete way it takes up the principles of electrical drafting and applies them to wiring and illumination. It would be improved if it had taken up the more complicated elements of drafting for electrical machines as well as for electrical circuits.

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Der Nutzglimmer

By H. Mohr. Published by Gebrüder Borntraeger, Berlin W 35. Schöneberger Ufer 12a. 275 pages, three inserts, 63 illustrations, numerous tables.

The title may be interpreted "Industrial Mica" as distinguished from mica considered primarily as a chemical or crystalline substance. The explanatory terms, "nature, occurrence, exploitation, uses," indicate more specifically the field here covered by a specialist who has devoted much attention to the mica problem as it affects mid-European industry, and who has consequently been led into a world-wide survey.

In the preface he writes: "Despite all this [importance in the electrical industry] there has been lacking a book, monographic in form, dealing with the scientifically and technologically important aspects in a balanced treatment, so far as that is possible. The purpose of the present monograph is to fill that gap."

A twelve-page bibliography and a particularly copious index—some otherwise excellent German books are woefully deficient in this respect—make this a useful work of reference, not merely an interesting book.

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The Modern Steam Turbine

By E. A. Kraft. VDI-Verlag, Berlin N. W. 7, Germany. 201 pages, 250 illustrations. Price, 20 reichsmarks.

A summary of the latest tendencies in steam turbine construction is given, with numerous examples of modern practice illustrated by drawings, curves and diagrams. The adoption of higher pressures and temperatures, the increasing output and speed, the resulting problems of appropriate materials and safe stresses, the many complicated methods of governing mixed pressure and extraction turbines and, lastly, the endeavor to attain the highest efficiency with the minimum of material, are all questions involving many problems which call for profound study. The book aims to present a critical survey in the light of these considerations. It is a translation of the recent German edition. The author's position as director of the Allgemeine Elektricitäts-Gesellschaft turbine works and honorary professor at a leading technical university is sufficient guarantee that the treatment is authoritative.

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Die Elektrizitätsgesetzgebung der Kulturländer der Erde

By Dr. Ing. G. Siegel. VDI Verlag, Berlin NW 7, Germany. Three volumes.

An exhaustive treatise on the legislation on electricity in the civilized countries of the world, prompted by the diversified treatment attending the growth of the electrical industry under the varying local conditions and governmental philosophies existing. Dr. Siegel, manager of the Electrical Supply Company of Berlin, has compiled, sifted, explained and commented upon the whole gamut of legal regulations on electrical matters. The work may well be called the "Webster of International Legislation on Electricity"; it is a handbook or manual in its broadest sense.

The first volume takes up the laws and ordinances, government decrees and legislative reports and also important papers published by the trade associations in the German Republic, the different German States and the Free City of Danzig. The second volume deals with western European countries and the third with northern and eastern Europe. The pertinent laws for the exploitation of water power, transcripts from laws and state constitutions, expropriations, etc., will be taken up, along with those pertaining to generation and distribution in overseas countries, including the United States of America, in a forthcoming fourth volume.

Men of the Industry

Dr. Harris J. Ryan Emeritus Professor

DR. HARRIS J. RYAN, who relinquished his academic duties as executive head of the electrical engineering department at Stanford University, California, as announced in the June 27 issue of the ELECTRICAL WORLD, is nationally known for his brilliant achievements in the engineering field. His research work has covered practically the entire field of electrical engineering from the development of direct-current machinery to

high-voltage long-distance transmission. Detailed descriptions of these studies have appeared in various technical publications and in particular in the *Proceedings* of the American Institute of Electrical Engineers. The response aroused by the publication of a paper on transformers in 1890 led to the adoption of the life principle by the author that, while training the student, his researches should be of maximum value to the engineer in the field. The consistent application of this principle has had as one of its most practical results the founding of the Harris J. Ryan high-voltage laboratory, which Dr. Ryan considers the greatest satisfaction of his career. Not the least of Dr. Ryan's contributions to the development of electrical science has been the work done by associates and graduate students who have been inspired by his genius and had the inestimable advantage of working under his sympathetic direction. For his contributions to the science and the art of high-tension transmission of power Dr. Ryan was awarded the Edison medal for the year 1925.

After a year's connection with the Western Engineering Company in Lincoln, Neb., he returned to Cornell, his alma mater. From 1890 to 1895 he served as assistant professor of electrical engineering in provisional charge of the department and then he received a full professorship and was made head of the department. He held that position until 1905, when he left Cornell to accept the position from which he is now retiring. He was born near Harrisburg, Pa., January 8, 1866. Dr. Ryan is a past-president of the American Institute of Electrical Engineers and holds membership in many other scientific societies.

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L. G. Ireland Elected to Vice-Presidency in New Orleans

LYALL G. IRELAND, for the past five years assistant to the vice-president of the New Orleans Public Service, Inc., has been elected to the vice-presidency of that Southern company. For many years Mr. Ireland has been identified with utility companies in the United States and Canada. A native of Canada, Mr. Ireland is a graduate of the University of Toronto, class of 1908.

He first entered the employ of the Midland Construction Company, the construction organization of the Electric Power Company, Ltd., of Toronto. In 1912 he became manager of the Brantford Hydro-Electric System, Brantford, Ont. Six years later he associated himself with the Hydro Power Commission of the Province of Ontario as manager of its Central Ontario System. He remained in this position until he came to New Orleans in 1924 as the manager of the Citizens' Light & Power Company. This company was later purchased by the Consumers Electric Light & Power Company and Mr. Ireland became the vice-president of the latter company. In 1926 the New Orleans Public Service purchased both of these companies and Mr. Ireland became assistant to the vice-president of the new company.

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WALTER F. ALLEN, who has been assistant director of publicity of the Public Service Corporation of New Jersey and subsidiary operating companies since 1926, was made director of publicity at a meeting of the board of directors to succeed the late Harlow C. Clark.

J. R. Cooke New Chairman of Ontario Commission

ANNOUNCEMENT HAS just been made of the appointment of J. R. Cooke, member of the Ontario Legislature, as permanent chairman of the Hydro-Electric Power Commission of Ontario and of Arthur Meighen of Toronto, former Conservative Prime Minister of Canada, to fill the vacancy on the board caused by Mr. Cooke's elevation.

Mr. Cooke, who is at present minister without portfolio in the Ontario govern-

ment, will not resign his seat in the Legislature, but will continue as government member of the commission in the provincial House. C. Alfred Maguire of Toronto will, it is understood, be promoted to the vice-chairmanship of the commission.

Mr. Cooke's long experience with the commission, which began some eleven years ago when he was appointed by the Legislature on the committee that studied the distribution of current to the rural parts of the province, and his eight years' service as a member of the commission under the late Sir Adam Beck and, latterly, C. A. Magrath, peculiarly fits him for this important position.

In connection with Mr. Meighen's appointment Premier George S. Henry, in making the announcement, said: "To fill the vacancy caused by the promotion of Mr. Cooke, the government has been able to persuade Mr. Meighen to join

the board as commissioner. We feel confident that this appointment will meet with public favor, as a man of Mr. Meighen's outstanding ability should assure the people of this province that the affairs of the Hydro-Electric Power Commission, which grows in importance year by year, are being placed in safe and sane hands."

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GEORGE H. ENGLISH, of Kansas City, Mo., has been appointed by Governor Henry S. Caulfield a member of the Public Service Commission to succeed S. M. Hutchison. Mr. English formerly was assistant United States District Attorney at Kansas City.

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J. W. JANTZEN, since December 1, 1925, a member of the engineering staff of the Central Arizona Light & Power Company, Phoenix, has been appointed district manager of that company's Glendale office. He has been placed in charge of the company's operations in the Glendale-Peoria district, for which the Glendale office is the northern headquarters.

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EARLE H. MORRIS, for the past eleven years chief engineer of the Board of Railroad Commissioners of the State of North Dakota, has been appointed chief engineer of the Public Service Commission of West Virginia. Mr. Morris is a member of the American Institute of Electrical Engineers and of the American Society of Civil Engineers.

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HORACE H. DODD, Dubuque, Iowa, has resigned as vice-president and general manager of the Central States Power & Light Corporation. Mr. Dodd has been a resident of Dubuque for about six years. He was for four years commercial manager of the Interstate Power Company and for two years general manager of the Central States Power & Light Corporation, both companies being subsidiaries of the Utilities Power & Light Corporation of Chicago, Ill.

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JOSEPH T. SULLIVAN, for nearly two years manager of the gas department of the Virginia Electric & Power Company at Norfolk, has been transferred to Richmond as general manager of the electrical department. Mr. Sullivan joined the Norfolk division of the Virginia Electric & Power Company in September, 1929. Prior to that he was manager of the Stone & Webster property operating in Reno, Nev. He has had wide experience in public utility operations and has been connected with the Stone & Webster organization for more than fifteen years, starting with it at Fall River, Mass.

L. B. Andrus Named President of Great Lakes Division

THE ELECTION OF Lucius B. Andrus of Indianapolis as president of the Great Lakes Division of the National Electric Light Association for the 1931-32 term has just been announced. A graduate of Ohio State University, Mr. Andrus has been identified with the public utility and electric manufacturing industries for upward of 30 years. His early experience was obtained with the Columbus (Ohio) Central Railway and with the Westinghouse Electric & Manufacturing Company. From 1904 through 1916 Mr. Andrus was connected with the Indiana & Michigan Electric Company at South Bend, Ind., as chief engineer and general superintendent in

charge of operations. For a course of lectures he gave, the University of Notre Dame awarded him the degrees of E.E. and E.E.M.S. In 1917 Mr. Andrus became a vice-president and director of the American Public Utilities Company. He exercised general supervision of operations during the time the Central Indiana Power Company was organized as a subsidiary to facilitate co-ordination of service among a number of small isolated utility companies in central Indiana.

Subsequent to this organization Mr. Andrus was active in the conception and construction of a system of electric transmission lines interconnecting the various communities served by the Dresser electric generating station of the Indiana Electric Corporation, a Central Indiana Power Company subsidiary, on the Wabash River near Terre Haute. He today is vice-president of the Central Indiana Power Company and its subsidiary, Indiana Electric Corporation, as well as president of Northern Indiana Power Company, another subsidiary, and vice-president of Public Service Company of Indiana, formerly Interstate Public Service Company. All these companies are in the Midland United Company group.

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OBITUARY

C. S. THOMPSON, 35 years old, distributing engineer for the Central Illinois Public Service Company, died suddenly at his home in Herrin, Ill., June 9.

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JAMES H. DEVEREUX, a mining engineer, died June 13 in Northampton, Mass., following a short illness. Mr. Devereux, who was 74 years of age, was a pioneer in hydro-electric development work in the West. He maintained offices in New York, but resided in Northampton.

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CHARLES HERMAN DICKEY, a director of the Pacific Gas & Electric Company, the Pacific Lighting Corporation, and the Southern Counties Gas Company and second vice-president of the last-named company, died in Del Monte, Calif., June 17, following a heart attack. He was an authority on public utility franchises and was the author of the book "Obligations Imposed by the Possession of a Franchise."

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FRANK BAILEY, M.I.C.E., one of the pioneers of electrical supply to London, has passed away at his home at Woldingham. Mr. Bailey worked with the late J. E. H. Gordon for the lighting of Paddington railway station in 1880. Later he was engineer to the Whitehall Electric Supply Company and was responsible for the building of the Sardinia Street station and the Manchester Square station, which supplied a large area of the northwest of the metropolis with current. In 1895 he was appointed engineer of the newly formed City of London Electric Lighting Company, and was then able to exercise his great powers of organization and control, so that in the early years he developed the electrical supply to the city of London which resulted in the electrification of the great newspaper printing works and cold storage warehouses. The generating station designed and established by him at Bankside, Southwark, throughout Mr. Bailey's administration maintained a high reputation for efficiency. After the war he took a leading part in the negotiations which resulted in the passing of the two acts of 1925 under which all the London supply companies are now operating.

Financial and Statistical News

ALTHOUGH dividend payments by all corporations were down 3 per cent during the first half year, as compared with the first half of 1930, public utilities showed an increase in dividends paid of more than 26 per cent. This was the largest gain made by any group with one exception.

——JUNE CLOSED WITH POWER AND LIGHT STOCKS showing a net loss of several points for the half year. The average of 37 representative common stocks is now 61.1, against 65.7 at the beginning of the year and a high of 74 in February. Averages are up only slightly over a week ago.

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Utility Bonds Called for Payment

ALL OF THE OUTSTANDING first and general mortgage 5½ per cent gold bonds, series C, due 1949, of the Central Maine Power Company, amounting to $1,550,000, have been called for payment August 1 at 104½ and interest.

Seven per cent sinking fund twenty-year gold debenture bonds of the Cleveland Electric Illuminating Company have been called for payment August 1 at 105 and interest.

All of the outstanding first mortgage 5 per cent 30-year gold bonds, series A, of the Nebraska Power Company and first mortgage 6 per cent 30-year gold bonds, series B, both due June 1, 1949, have been called for payment July 24 next at 105 and interest.

Certain first and refunding mortgage 5½ per cent gold bonds, due 1954, of the Syracuse (N. Y.) Lighting Company, amounting to $30,000, have been drawn by lot for redemption at 106 and interest on August 1.

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New Capital Issues

DURING THE FIRST WEEK of July the Midland United Company issued serial gold notes to the amount of $11,000,000, at prices to yield from 2¼ per cent to 4¾ per cent. These notes will be a direct obligation of the company, which owns and controls public utility companies serving 872 communities in Indiana, Ohio, Illinois and Michigan.

Rochester Gas & Electric Corporation made an offering of 3 per cent gold notes, totaling $10,000,000, the price being 100 and accrued interest. These notes, dated July 16, 1931, mature July 15, 1932.

May Revenues Decline Normally

ELECTRIC LIGHT AND POWER operations in May brought slightly less revenue this year than last, according to returns thus far received by the ELECTRICAL WORLD. On the basis of these returns it is estimated that the total for the entire industry in the United States was $170,600,000, against $172,900,000 a year ago, a decrease of 1.3 per cent. The seasonal decrease from the $176,370,000 for April, as published in the issue of June 27, is larger than in 1929 or 1930, but does not exceed the normal drop at this time as established by the records of former years.

Distinct gains over last year's earnings are evident in only two geographical regions, the Middle Atlantic and the Pacific. Reports from the central industrial area show about the same situation as in other recent months, the average being down 4 per cent.

This preliminary estimate is subject to modification, probably slight, when addtional returns are received.

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Government Gets Huge Share of Utility Revenue

THAT the utilities pay more than $200,000,000 in taxes yearly is a matter of public record. That this is equivalent to about one-third of the net revenue of many utilities is not so generally known.

The huge proportion of utility revenue that finds its way into government coffers would undoubtedly amaze many advocates of government ownership, among others. Last year a representative group of twelve companies paid an amount equivalent to 26 per cent of net revenue, after depreciation, in the form of taxes to federal, state and local governments. In one case the tax toll was more than 33 per cent. The lowest in the group studied was 18 per cent.

This group of twelve companies, five holding and seven operating, paid a total of $73,000,000 in taxes, while they netted to their owners, the common-stock holders, only $108,000,000. In other words, the government received an amount equivalent to two-thirds of the return to common-stock holders. For the same period $56,000,000 was paid to preferred-stock holders. This, it may be assumed, is part of the cost of capital. Even if it be construed wholly as return to ownership, the tax total is 45 per cent of all dividends.

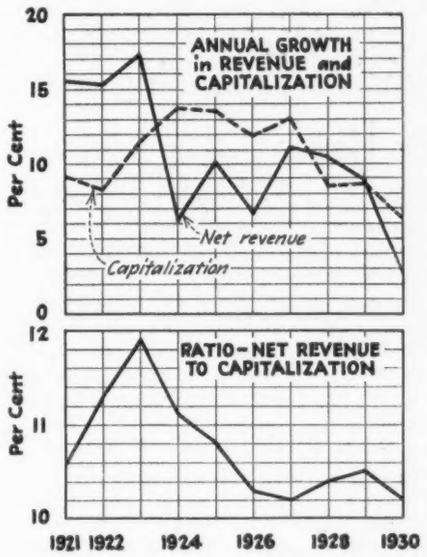
Quarter to One-third Net Revenue Paid in Taxes

Company	Preferred Dividends	Common Dividends	Taxes	Relation of Taxes to Net Revenue, Per Cent
A	$21,327,515	$20,400,000	$14,002,056	22
B	12,023,101	10,318,952	10,070,064	27
C	5,437,796	1,864,562	3,732,224	22
D	5,879,991	21,744,253	7,607,419	23
E	3,568,613	5,558,241	8,178,270	25
F	.....	9,896,922	5,750,000	33
G	1,110,260	4,082,973	2,922,052	31
H	.....	7,274,300	4,314,082	32
I	.....	11,064,270	6,600,000	28
J	6,940,529	5,749,835	4,153,397	18
K	.....	7,200,000	5,222,870	30
L	240,000	3,138,000	1,306,022	24
	$56,527,805	$108,292,308	$73,858,456	
			Average.....	26

Utilities Are Impregnable, Survey Shows

THERE is no ground for pessimism in the utility industry. Rigid analysis of the various indexes and trends in the central-station field fails to uncover any justification for fear in regard to the future. The position disclosed is more nearly impregnable than that of any other major industry.

These statements are based primarily on a study of revenue figures. A representative group of more than 50 operating companies declined but 1.2 per cent in gross revenue for the twelvemonth period ended May 31 and a group of holding companies shows a 1.4 per cent decline for operating and 1.6 per cent for holding companies. A detailed study of operating figures shows this negligible decline was in the face of numerous rate reductions, but was accomplished by the adoption of rigid economies in many directions. Otherwise the earnings figures would have tended to follow the general course of industry, industrial power use playing the dominant part.



A study of the ratio between net revenue and capital invested in the industry gives the same results. This ratio, which means, virtually, return on capital, shows an almost uninterrupted upward trend since 1927, disturbed to only a minor degree last year.

How the position of the utilities compares with that of other industries was discussed by W. A. Jones in his presidential address at the N.E.L.A. convention. Mr. Jones said:

"Comparisons are often misleading, but it is of more than passing interest to consider an analysis made by one of the largest statistical organizations of the country of the reports of more than 600 corporations for the first three months of the years 1930 and 1931. This analysis shows that the first quarter's earnings of these 600 corporations this year are 38.4 per cent below the corresponding period of 1930. Of the companies included in this analysis, 259 were industrial corporations, the earnings of which, taken as a whole, were 54.8 per cent under those of the previous year; 171 were railways, which show a decrease of 39.3 per cent, and 76 were light, power and gas companies, with a decrease of only 1.6 per cent."

The credit position of the industry also is in an unprecedented position. New financing is being currently carried out at the lowest interest rates in the industry's history. While most high-grade issues bear coupon rates between 4½ and 5 per cent, a few 4 per cent issues have already been placed and more are anticipated. Several substantial issues with 4 per cent coupons have been floated within the past two months.

Why, then, are the utilities cutting their 1931 budget from $919,418,000 spent in 1930 to $702,000,000, as announced by the National Electric Light Association? One important factor in the 23 per cent difference is the steady decline in material and construction costs. Another consideration is that the 1930 figure was well above the average and the largest figure on record. "The actual physical volume of new work more nearly approximates the general average of previous years than the figures would seem to indicate," N.E.L.A. says.

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NEWS BRIEFS

Announcement has been made that the Lynn (Mass.) Gas & Electric Company has paid a quarterly dividend of $1.50 per share on its captial stock. Previously the company paid quarterly dividends of $1.25 per share.

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General Gas & Electric Corporation has called for redemption as of July 15 certain serial gold notes, amounting to $7,500,000, due August 15, 1931.

•

Group insurance covering its 4,100 employees has been contracted for by the Southern California Edison Company, Ltd., with the Aetna Life Insurance Company of Hartford, Conn. The total involves $12,000,000.

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Directors of the Texas-Louisiana Power Company have voted to defer the quarterly dividend of 1¾ per cent due July 1 on the 7 per cent cumulative preferred stock, par $100. The last quarterly distribution on this issue was made April 1, 1931.

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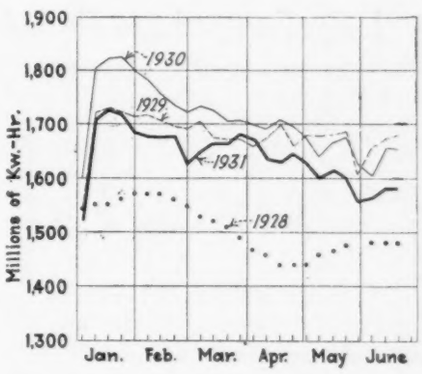
Weekly Energy Output

OUTPUT OF ELECTRIC light and power companies in the United States, as estimated by the statistical research department of the National Electric Light Association, is shown in the accompanying chart. For recent weeks and correspondingly in preceding years the energy generated was:



Week Ended	Millions of Kw.-Hr. 1931	1930	1929	1928
May 30	1,565	1,627	1,606	1,370
June 6	1,562	1,608	1,653	1,480
June 13	1,581	1,663	1,675	1,480
June 20	1,579	1,656	1,678	1,480
June 27	.....	.....	.....	.....

The output continues smaller than in 1929 and 1930. The chief decrease, compared with last year, is still in the central industrial region, although the Chicago district has lately come within 2 or 3 per cent of last year's figure. The Pacific Coast has for several weeks reported losses as high as 6 per cent, while the Atlantic seaboard has been close to last year's level.

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Recent Listings

NEW YORK STOCK EXCHANGE has authorized the listing of twenty-year 4½ per cent gold debenture bonds, due June 1, 1951, amounting to $60,000,000 of the Consolidated Gas Company of New York and of 4,892 additional shares of common stock of the Federal Light & Traction Company on official notice of issuance as a stock dividend. There

have also been authorized for listing first mortgage gold bonds, 4½ per cent series, due 1981, of the Pennsylvania Power & Light Company, totaling $121,000,000.

Recently the New York Stock Exchange authorized the listing of first and refunding mortgage gold bonds, 4 per cent series, of the Public Service Electric & Gas Company to the amount of $26,000,000. There have also been authorized for listing on the big board 38,000 additional shares of class A stock of the Utilities Power & Light Corporation on official notice of issuance and payment in full by sale to stockholders in lieu of cash dividend, making the total amount applied for 1,867,000 shares of class A stock.

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Large Foreign Loan Floated

FOR THE FIRST TIME in many months a foreign utility company has entered the American market with a substantial offering of bonds. The Taiwan Electric Power Company, Ltd., issued 40-year sinking fund 5½ per cent gold bonds to the amount of $22,800,000 at 93½ and accrued interest, to yield more than 5.90 per cent to maturity.

The Island of Taiwan (Formosa) is a part of the Japanese Empire and the bonds are unconditionally guaranteed by the government of Japan as to principal, interest and sinking fund. The Taiwan Electric Power Company, which was formed in 1919 to consolidate electric plants previously operated by the government and by private capital, does approximately 95 per cent of the power and light business of the island.

Proceeds are to be used to provide funds for the expansion of the company's facilities by the completion of a 100,000-kw. hydro-electric development at Lake Jitsu-Getsu-Tan.

Canadian Output Grows

THE DAILY AVERAGE PRODUCTION of electrical energy from central stations in Canada during April improved to 46,268,000 kw.-hr., as contrasted with 44,903,000 kw.-hr. in March. Notable among the territorial divisions is the province of Quebec, which jumped its daily average of water power produced to 23,930,000 kw.-hr., a gain of 1,230,000 over March. This means that the province contributed about 90 per cent of the entire country-wide increase in April over March. With new power contracts coming in from time to time the immediate outlook is that over the next few years Quebec's power production will gain at a brisk rate, this naturally being helped along by the increasing absorption of Quebec energy by the Ontario Hydro system.

Ontario showed a decrease in daily average output during April at 13,849,000 kw.-hr., a contraction from the preceding month of 729,000 kw.-hr. The Maritime Provinces gained 530,000 kw.-hr., at 1,738,000; the Prairie Provinces gained 288,000, at 3,384,000, while British Columbia decreased 56,000, at 3,365,000 kw.-hr., as compared with the previous month.

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Utilities Do Extensive Financing at Lower Rates

AS A result of the upward swing in the bond market which developed at the end of June a group of substantial utility issues were offered and absorbed by the investing public, bringing the total for the month up to $195,216,000, as compared with $189,415,000 in May and $187,344,600 in June, 1930. Only eleven individual companies participated in the month's activities so that the total was the result of the size of the offerings rather than of their number. An issue of first mortgage gold bonds of the Commonwealth Edison Company accounts for $85,000,000 of the month's total. Perhaps the most striking feature of the new financing is the exceedingly low rates at which electric light and power companies are disposing of their bonds. Seven issues were 4½s and one was a 4, the remaining three being note issues, paying in two cases 3 per cent and in one case 4 per cent.

Total financing by the electric light and power companies for the six months ended June 30 amounted to $973,945,000, as against $745,452,100 for the similar period of 1930. Attention is called to the prominent part refunding operations have taken in the year's financing to date $627,000,000, the balance, $346,000,000 representing new capital.

It is interesting to note the slump which has occurred in foreign financing during the current year. During the past few years a substantial amount of capital has been placed in foreign utility securities, the amount ranging from approximately $100,000,000 to $250,000,000 annually. Last week the first foreign loan (with the exception of two small Canadian issues) appeared, an issue of bonds of the Taiwan Electric Power Company (Japan), amounting to $22,800,000. This re-entry into the American market of the Japanese utility is looked upon in banking circles as the first step in the resumption of more extensive foreign financing in the near future.

New Security Issues of Electric Service Companies in June

Name of Company	Amount	Period (Years)	Class	Purpose	Interest Rate	Price	Per Cent Yield
Staten Island Edison Corp.	$7,500,000	1	Gold notes	To repay advances made for new construction and for other corporate purposes	3	100	3.00
New Bedford Gas & Edison Light Co.	4,500,000	1	Gold notes	To retire outstanding debt	3	100	3.00
Portland General Electric Co.	7,500,000	2	Gold notes	To retire indebtedness incurred for new construction, to provide additional working capital and for other corporate purposes	4	99½	4.50
Northern States Power Co.	10,000,000	30	Refunding mortgage gold bonds	To reimburse for expenditures for additions made to properties	4½	98½	4.59
Safe Harbor Water Power Corp.	21,000,000	48	First mortgage sinking fund gold bonds	To raise funds for expenditures on construction and to provide working capital	4½	96½	4.68
Detroit Edison Co.	15,016,000	30	General and refunding mortgage gold bonds, series D	To reimburse for expenditures made for additions to its plants and systems	4½	103½	4.28
Jersey Central Power & Light Co.	32,000,000	30	First mortgage gold bonds, series C	To acquire properties of Eastern New Jersey Power Company and for refunding purposes	4½	101	4.45
Commonwealth Edison	85,000,000	50	First mortgage gold bonds, series F	To retire bonds and to reimburse the company in part for capital expenditures made in the development of its properties	4	94½	4.25
Houston Lighting & Power Co.	4,500,000	50	First lien and refunding mortgage gold bonds, series E	Refunding and other corporate purposes	4½	98½	4.57
Wisconsin Michigan Power Co.	5,000,000	30	First mortgage gold bonds	To retire bonds and to reimburse for expenditures on additions	4½	100½	4.47
Central Illinois Public Service Co.	3,200,000	50	First mortgage gold bonds, series H		4½	92	4.93
Total	$195,216,000			Rights, $14,185,550			
Total amount actually realized	190,137,010			Total financing for June	$204,322,560		

Business News and Markets

World Copper Use Cut 18 per cent in 1930

CUTTING PRODUCTION 18 per cent from that of the preceding year the world's output of copper in 1930 came virtually to 1,750,000 short tons. North America furnished 55 per cent of the total and suffered a decrease of 24 per cent compared with 1929. This information is taken from the 1930 Yearbook of the American Bureau of Metal Statistics, which gives production and consumption data on various non-ferrous metals.

The adverse change last year was confined to the Americas, as the following table shows:

World Production of Copper

(Short Tons)

	1928	1929	1930
Total No. America	1,123,281	1,249,998	955,851
Total So. America	386,302	416,045	302,559
Total Europe	142,430	175,020	185,290
Total Asia	80,813	91,989	100,924
Australasia	13,244	15,979	17,156
Africa	141,131	172,561	182,680
Other countries	4,409	5,512	5,512
Grand totals	1,891,610	2,127,104	1,749,972

For earlier years corresponding totals for North America and for the world were, respectively:

1919	722,083	1,069,998
1920	731,726	1,082,652
1921	283,228	601,913
1922	578,900	996,147
1923	866,731	1,411,980
1924	938,953	1,522,394
1925	982,490	1,589,717
1926	1,017,461	1,637,489
1927	997,415	1,682,361

The estimated allocation gives about 82 per cent of the United States production of 710,690 tons in 1930 to distinctly electrical uses. For the past three years it was, in tons:

Estimated Use of Copper in the United States

(Short Tons)

Purpose	1928	1929	1930
Electrical manufactures*	213,000	261,000	221,000
Telephones and telegraphs	119,000	164,000	122,000
Light and power lines†	115,000	127,000	130,000
Other wire	87,100	106,200	93,700
Radio receiving sets	8,400	15,500	13,000

*Generators, motors, electric locomotives, switchboards, light bulbs, etc.

†Transmission and distribution wire and bus bars.

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Issues Bulletin on Power Transformers

IT WOULD BE DIFFICULT or impossible to tell the complete story of power transformer design and operation within the limited scope of a 64-page leaflet, yet the Wagner Electric Corporation has gone far toward doing so, incorporating a discussion of recent improvements.

Bulletin 170 deals in detail with transformer ratings, types, design and construction. It discusses separately single-phase and three-phase construction, enlarging upon such factors as coil, tank and base construction, expansion tanks, valves, bushings, etc.

Precautions to be taken when handling transformer oil and when obtaining oil samples are discussed carefully, as is also transformer oil storage in the field. The bulletin is thoroughly illustrated.

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Interstate Electrical Manufacturers' Association

AT A MEETING held in New York recently the Interstate Electrical Manufacturers' Association, Inc., promoted plans for increasing its membership and launching policies of mutual interest to members. L. C. Fletcher has been appointed first managing director and is located at 461 Eighth Avenue, New York.

The new organization was set up to give voice to the manufacturers of metropolitan New York and to branch managers and agents of out-of-town manufacturers in their relations with all other industry groups.

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Nearly $50,000,000 for Rural Service

ELECTRIC SERVICE IS RECEIVED by 644,421 farms, using 1,799,947,000 kw.-hr. annually, or three times the amount sold for railroad electrification, and bringing a total revenue of $46,187,600. The figures apply to the year 1930 or to the end of that year. They are the result of studies made by the statistical research department of the National Electric Light Association, by extending the figures of reporting companies to embrace an estimated 100 per cent of the electric industry, and are subject to revision upon the eventual publication of the various statistics of the 1929 census of agriculture.

To separate the farms using much energy for irrigation it was assumed that farms to the west of the one-

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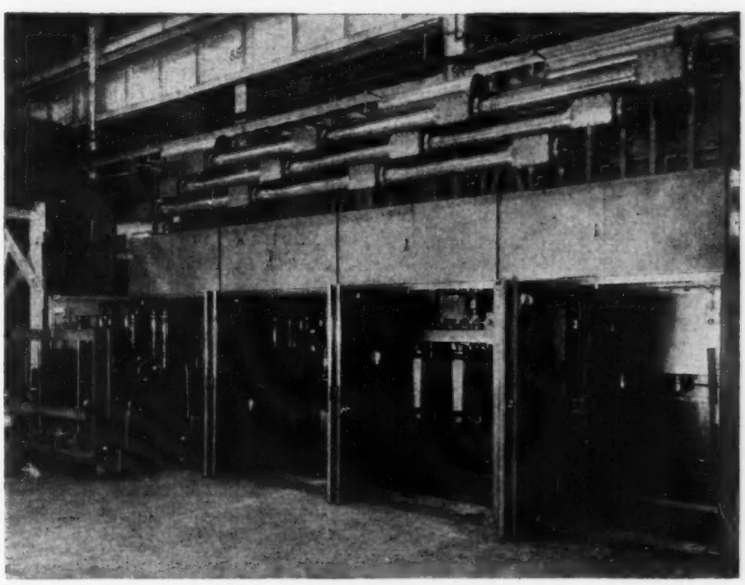
OIL-FILLED, METAL-INCLOSED SWITCHGEAR



A four-unit section of indoor, metal-inclosed, vertical lift type, oil-filled switchgear built for the Joy Road substation, city of Detroit, by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This section is connected to a similar section with an ultimate capacity of ten units. At the extreme left is illustrated the method of removing a breaker from its housing.

hundredth meridian depend on irrigation, while those to the east of it do not. The assumption is recognized as arbitrary, but had to be made in the absence of definite information.

Thus divided, 200,962 Western farms use 1,475,911,000 kw.-hr., costing $25,278,400; 443,459 Eastern farms use 304,036,000 kw.-hr., costing $20,909,200.

In the Eastern group the average annual consumption was 740 kw.-hr., the average bill $50.91, or 6.88 cents per kilowatt-hour.

The figures for the average non-irrigating farm are comparable with those reported in 1929 and have the same general trends as domestic service. The two years compare as follows:

Non-irrigating farms	1930	1929	Change, Per Cent Inc. or Dec.
Average kw.-hr.	740	707	+5
Average rate, cents per kw.-hr.	6.88	6.93	−1
Ave. annual bill	$50.91	$49.00	+4

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Equipment Requirements of Canadian Provinces

APPROVAL BY THE VARIOUS Canadian provinces of American electrical equipment and appliances admitted is the subject of circular 607 issued by the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Washington. The circular discusses what certificates of inspection or underwriters' approval are demanded.

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Refrigerator Sales Show Steady Gains

ACCORDING TO A STATEMENT made by the Standard Statistics Company, refrigerator manufacturers are among the few companies which registered steady expansion of sales since the beginning of the depression. The report states:

Distribution of household and commercial units reached 1,002,000 in 1930, according to data published by *Electric Refrigeration News*, compared with 902,000 in 1929 and 635,000 in 1928. Current reports indicate that this strong uptrend of business has been maintained thus far in 1931. Practically without exception the leading producers are reporting sizable sales gains.

One advantage which the electric refrigeration industry is enjoying this year is the aggressive effort being extended by the utility companies to expand distribution. The impetus behind this aggressive campaign on the part of the utilities is the fact that the installation of a new electric refrigerator assures about as much additional load to the utility company as does the building of an average one-family dwelling house.

Because of the extensive unexploited field for mechanical refrigeration, and the forces which are at work to develop and supply the potential demand, it is our opinion the next several years will mark a period of continued rapid growth.

Construction Necessary to Speed Recovery*

By E. C. STONE

Vice-President Middle Eastern District, American Institute of Electrical Engineers

1. Booms and depressions are the result of mass action, and mass action will be required to level them out. Depressions are the result of the excesses of booms, so that to prevent depressions steps must be taken to avoid the inflation of booms.

2. Business cycles are the result of variations in the relative intensity of supply and demand. The fact that we can save a part of our earnings is probably an important cause, because savings are not necessarily put back into circulation at once, but may be accumulated in the banks until satisfactory channels for investment are available.

3. The major part of savings is ultimately spent for construction of permanent improvements which will yield an interest return. Volume of construction is a fundamental factor in business prosperity because it determines the over-all maximum demand for goods and labor. Increasing volume of construction is the impulse which turns depressions into prosperity.

4. The boom of 1929 involved high-pressure selling, heavy volume of construction and a bull stock market, all of which tended to advance into 1929 demands for goods which normally would not have developed until 1930-31, and therefore reduced the normal demands of these years, hence the depression.

5. There appear to be two possibilities for action toward smoothing out the business cycle:

(a) Co-ordinated action between individual companies in the various industries and between the industries themselves.

(b) Planning of the construction of public improvements so as to fit into and offset periods of reduced business activity.

6. Consistent improvement in present conditions will not come about until the volume of construction gets back to an amount approaching that of past years. This should occur soon, however, because of the rapid absorption of excess capacity through the demands of an increasing population, and as a result of depreciation and obsolescence in this rapidly advancing age.

**From an address presented at Lehigh Valley Section, A.I.E.E., Hazelton, Pa.*

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Living Costs Continue Downward

THE LIVING COSTS of the average wage earner are lower than at any time recorded during the past twelve years. This is shown in the forthcoming report on the "Cost of Living in the United States, 1914-1930," which is the latest in the series of annual volumes on this subject published by the National Industrial Conference Board.

In 1930, as a whole, the cost of living averaged 3.8 per cent lower than in 1929 and 4.2 per cent lower than in 1928. At the end of the year the index was at the lowest point recorded during the past twelve years, the index standing at exactly the same point in December, 1930, as in June, 1918. In April, 1931, the downward trend was still apparent, the index being 4.8 per cent lower than in December, 1930, and 11.8 per cent lower than in 1923, the newly adopted base index year used for the first time by the conference board in this report.

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New York Metal Prices

	June 24, 1931 Cents per Pound	July 1, 1931 Cents per Pound
Copper, electrolytic	8.50	8⅛–8¼
Lead, Am. S. & R. price	4.25	4.40
Antimony	6.25	7
Nickel, ingot	35	35
Zinc, spot	3.85	4.25
Tin, Straits	22.20	25⅛
Aluminum, 99 per cent.	23.30	23.30

Market Conditions

EASTERN district business shows a gradual up-trend, even independent of the outcome of debt postponement negotiations. This week's news carries a list of interesting orders from power companies. The iron and steel industry promises increasing demand for equipment.

——ELECTRICAL BUSINESS IS REPORTED AS DECIDEDLY SPOTTY in the Pacific Coast area this week. Carrying out of projected public works is expected to give a substantial impetus to trade within the next two months.

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PACIFIC COAST

—THE ELECTRICAL BUSINESS *is decidedly spotty, according to reports not only from various branches of the industry, but also from various classifications of workers. Outside salesmen report business to be very poor, there being few orders for immediate shipment. However, inside salesmen, who are more interested in input, and estimators who are figuring future jobs assert that things are decidedly better.*

—GOVERNMENT BIDDING *has considerably decreased, but orders bid for in spring, when public works on a large scale were planned to relieve depression, will be shipped within the next few months. State business is excellent, as various departments hasten to use up accumulated budgets before the fiscal year ends on June 30.*

Switch and switchboard manufacturers claim to be holding a sizable amount of jobs for shipment within the next 30 days or so, so that on the whole there is considerable justification for the widely held belief that August 1 will mark the definite resumption of large scale and widely distributed buying. However, the first five months' electrical sales show a decrease averaging more than 30 per cent for the coast over last year, ranging from 23 per cent in the Bay area and 30 per cent in southern California to 40 per cent in Portland and 27 per cent in Seattle. Machinery firms report the greatest scarcity of new major equipment inquiries in over a decade. The big programs have been finished for the year, but there are no overlapping larger jobs ready for figuring, as hitherto. Power companies are evidently waiting for an increased normal demand before adding to their facilities.

An encouraging factor is stronger prices, several lines reporting increases or stronger basic conditions. Job prices, however, are subject to a good deal of chiseling. Actual orders are fairly good, even though few, including such jobs as $50,000 worth of Westinghouse motors and controls for a San Francisco passenger ship, $15,000 worth of pumping plant rotors and stators for a Los Angeles pumping plant manufacturer, $25,000 worth of electric shovel equipment for the Hoover Dam and $6,000 worth of supervisory control material for an irrigation district.

Plans for the development of Campbell River for practically its entire length, for ultimate production of 157,000 hp., 119,200 hp. of which would be available continuously, have been filed by the British Columbia Electric Railway Company with the Provincial Water Board at Victoria, B. C. The plans, which provide for three power plants and four dams, will be the subject of an official hearing within the next few weeks. A bill was introduced in Seattle City Council providing for extension of the municipal light distribution system, involving an outlay of $280,000. Pacific Telephone & Telegraph Company will spend $40,000 in line extension in the Grays Harbor district and $47,000 in rebuilding lines between Touchet and Wallula, in the Walla-Walla district. Specifications for motors for the projected $250,000 grain elevator in Spokane are being written, it is reported, and the contract for the structure, with a capacity of 750,000 bush., has been let by the Farmers' National Grain Corporation. Apparatus sales last week were negligible and motor sales extremely light.

CONSTRUCTION PROJECTS

Pasadena Junior College, Pasadena, Calif., has plans for an engineering laboratory and mechanical training shop to cost about $100,000. Albert C. Martin, Los Angeles, Calif., architect, has plans for an automobile service, repair and garage building to cost $250,000. Armstrong Machinery Company, Spokane, Wash., contemplates, improvements to cost close to $60,000. Lone Star Timber & Pulp Company, Seattle, Wash., contemplates pulp and paper mill at Port Renfrew, B. C., to cost about $1,500,000. Western Light & Power Company, Washougal, Wash., plans hydro-electric power plant on Cougar Creek, reported to cost over $200,000.

SOUTHWEST

—THE ONLY REALLY LIVE *line in electrical business for the past week has been fans, and stocks are said to be disappearing very rapidly. The demand for medium sizes of apparatus has kept up to nearly a normal point.*

A contract has been closed for a 750-kw. turbo-generator for a Missouri municipal plant amounting to $23,000. Orders were placed by two central stations for induction voltage regulators, one for $4,000 and the other $5,000.

CONSTRUCTION PROJECTS

Missouri State Highway Department, Jefferson City, Mo., plans group of equipment maintenance and repair shops to cost over $150,000. Od-Peacock-Sultan Company, St. Louis, Mo., has filed plans for a multi-story chemical plant to cost over $100,000. Globe Oil & Refining Company, Blackwell, Okla., contemplates oil refining plant at Dallas, Tex., to cost about $600,000, and will build oil storage and distributing plant near Wichita, Kan., to cost close to $100,000. Oklahoma Gas & Electric Company, Oklahoma City, Okla., plans extensions and improvements in transmission lines at Lamont, Morrison and neighboring points in the state. Central & Southwest Utilities Company, Shreveport, La., plans addition to power plant to cost over $200,000.

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MIDDLE WEST

—GENERAL BUSINESS IN THE *Middle West section continues to show improvement. While it is admittedly slight, confidence is returning and better business is in sight. The major industries are maintaining their positions and some improvement in industrial activity is observed.*

Although June sales of new automobiles show a decrease, the automotive industry continues optimistic and anticipates a steady demand for automobiles. Preliminary second quarter reports of earnings in many instances show some increase and the consensus of opinion seems to be that business is definitely on the up-grade again. Wholesale trade compares favorably with a similar period last year and the recent hot weather has stimulated retail business somewhat. Among the interesting orders placed this week are the following: Construction of a substation to cost $45,000, structural steel for substation to cost approximately $52,000, construction of switch yard foundation to cost approximately $85,000, and 100 10-kva., single-phase pole type distribution transformers.

CONSTRUCTION PROJECTS

Wisconsin Power & Light Company, Madison, Wis., plans power substation at Janesville, Wis. Ford Motor Company, Dearborn, Mich., plans hydro-electric

power plant near Rawsonville, Mich., on Huron River, to cost more than $2,000,000. Detroit Edison Company, Detroit, Mich., plans addition to research laboratory at Delray plant. Signal Supply Officer, Signal Corps, United States Army, Chicago, Ill., will receive bids until July 7 for cable racks, relay racks, relay assemblies, telephone frames, etc. (Circular 82). Republic Steel Corporation, Youngstown, Ohio, plans expansion and improvements at plant at Massillon, Ohio, to cost $300,000. Northern Normal and Industrial School, Aberdeen, S. D., will receive bids until July 10 for power house equipment,. including stokers, coal and ash-handling equipment, etc. Alta, Iowa, will receive bids until July 14 for engine-generator set and other equipment for municipal power plant.

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EASTERN

—A LEADING MANUFACTURER *of heavy and light electrical equipment sums up the local market situation with the comment that "personal observations show that there is a gradual healthy advance in trade; even if the Hoover moratorium plan should fail of acceptance, definite market needs will continue to increase sales."*

—A NOTABLE AWARD *for electric meters from a metropolitan utility company heads a list of rather encouraging commitments for the week. Orders being placed in the iron and steel industry foreshadow an increasing demand for electrical equipment from that quarter. Marine account gives indications of growing proportions, with several heavy impending awards. Government business continues to carry encouraging aspects.*

The Brooklyn Edison Company has authorized a fund of $5,000,000, in addition to regular 1931 budget previously arranged, for underground lines in about 25 miles of streets in the borough, replacing present overhead system; it is estimated that the work will require from eight to nine months for completion. A group of metropolitan utility companies has placed a contract for watt-hour meters with a New York manufacturer, totaling $1,600,000. An order for a steam-turbine unit for municipal service at Woodstock, Ill., has been secured by the General Electric Company, the contract for the condenser going to the Foster-Wheeler Corporation. The General Electric Company is also the successful bidder for three transformers for Fresno, Calif. A number of Eastern companies have tendered figures for a rotary air compressor for Pasadena, Calif., and an early award is looked for.

Contracts are being placed by Martinsville, Va., for electrical and water-power equipment for municipal station service, the first being secured by a New York maker, with waterwheel equipment going to a Pennsylvania manufacturer. W. R. Grace & Company, operating the Grace Line to South American ports, has work under way on the first of four vessels at the yard of the Federal Shipbuilding & Dry Dock Company, Kearny, N. J., to cost $4,500,000, with electric and other machinery. The four steamers will represent an investment of about $17,000,000 and are scheduled to be completed in two years. With construction commitments totaling about $150,000,000 to date, the Navy Department, Washington, D. C., is arranging to award additional contracts for government vessels to an amount of $50,000,000, requiring sizable quantities of electrical machinery.

CONSTRUCTION PROJECTS

Constructing Quartermaster, Mitchel Field, New York, will receive bids until July 23 for four air corps hangars, air corps machine shop, assembly shop, photographic laboratory, radio building, headquarters and operating building and other units, as per specifications on file. Standard Oil Company of New Jersey, New York, will build an oil refinery at Port Jerome, France, through its French subsidiary, Société Franco-Americaine de Raffinage, Paris, France to cost over $1,500,000. Department of Hospitals, New York, has secured an appropriation of $150,000 for automobile service and garage building at institution on Welfare Island. Public Service Electric & Gas Company, Newark, N. J., has plans maturing for power substation at Springfield, to cost over $100,000. Board of Public Education, Philadelphia, Pa., will receive bids until July 7 for motors, switchboard and other electrical supplies. Emblem Oil Company, Warren, Pa., will establish an oil storage and distributing plant at East Warren, to cost about $80,000.

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SOUTHEAST

—NEWS FROM WASHINGTON *has had a somewhat stimulating effect in this section, though this is not as yet reflected in anything tangible. One of the largest manufacturers reports transformer and meter orders on the increase, with all reporting concerns stating their general volume of business fairly well sustained.*

One company's wire orders last week aggregated $18,700, while a Florida west coast company ordered one car of bare and weatherproof copper wire and a Florida east coast company ordered 15,000 lb. of bare copper. A Georgia company's transformer orders in the past ten days aggregated $6,300 and its crossarms and creosoted pine pole orders for the same period were $5,100. A Mississippi power company ordered $6,000 worth of switchboard equipment. A new industrial in Georgia last week placed orders for wiring supplies amounting to approximately $25,000, and a cotton oil mill in the same state ordered motor equipment amounting to $6,000. The federal penitentiary at Atlanta ordered $2,500 worth of small motors. An order for distribution transformers totaling $31,300 was placed for use in a hospital out of this territory.

CONSTRUCTION PROJECTS

Southern Kentucky Oil Producers' Association, Bowling Green, Ky., contemplates oil refining plant to cost over $100,000. Tennessee Electric Power Company, Chattanooga, Tenn., plans extensions in transmission lines for rural service to cost over $125,000. Memphis Power & Light Company, Memphis, Tenn., has filed plans for power plant to cost in excess of $100,000. Florida Power & Light Company, Fort Myers, Fla., plans transmission line from Fort Myers to LaBelle and vicinity, with substation facilities, to cost about $60,000.

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NEW ENGLAND

—ELECTRICAL EQUIPMENT *orders in the New England district indicate a wider range in interest than during the previous month, though sales are still confined to small lots. Power equipment is steady and the past month's volume was low as compared with last year.*

One manufacturer reports steadiness in buying single motors and an encouraging upward trend in fractional-horsepower sizes, while another notes inquiries for special heavy-duty motors for pumping purposes. Scheduled material sales are more active and control equipment orders increased, with one representative recording activity in high-voltage control apparatus. Two transformer substations for the Ossipee district totaling 600 kva. have been recently ordered. Interior lighting is receiving some attention and street lighting is more active. Among the latter projects closed last week is noted a plan for the installation of 75 1,000-cp. lamps for the southern New England district. Representatives of special lines report inquiries in good volume, including industrial electric trucks and arc-welding units. Apparatus for farm purposes is receiving interest, with recent sales of 30 electric brooders, 440 watts each.

CONSTRUCTION PROJECTS

International Harvester Company, Boston, Mass., has plans for a service, repair and distributing plant for motor truck division at Brighton, estimated to cost over $100,000. Monson State Hospital, Palmer, Mass., has plans under way for power house to cost over $300,000. Connecticut Light & Power Company, Hartford, Conn., has filed plans for power station at Bristol, Conn., to cost over $150,000.

New Equipment Available

Direct-Drive High-Vacuum Pump

A REDESIGNED TYPE of direct-drive high-vacuum pump has been announced by the Eisler Electric Corporation, Newark, N. J. These units are driven by means of a reduction-geared motor which rotates pistons at the proper speed. This direct drive is noiseless and efficient in operation, it is claimed. These pumps are employed wherever a

high degree of vacuum is required. They are used in the manufacture of radio tubes, incandescent lamps, neon signs, vacuum bottles, etc. The high-vacuum pump is a self-contained unit, requiring no preliminary or finishing pump. It will produce a vacuum of 0.05 micron of mercury, McLeod gage reading, or better when connected to a vacuum tight system, in which no vapors are given off.

The compound pump is immersed in vacuum oil, the level of which is above pump unit. This aids effectively in sealing the pump from the atmosphere and distributes any heat that may be generated by friction, preventing displacements of parts through expansion.

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D. C. Automatic Starting Speed Regulator

A NEWLY DESIGNED AUTOMATIC starting regulator for d.c. motors up to 3 hp. is announced by Cutler Hammer, Inc., Milwaukee, Wis. This regulator is of the counter-emf. type, non-reversing, and is arranged to give 50 per cent speed regulation below normal by armature control and 100 per cent speed increase by field weakening. It is designed for constant torque duty, where the load is constant and independent of the speed, for motors on platen (job) presses, folders, paper box making machinery, textile machines and similar equipment.

Some of the features of this controller are automatic starting with a definite, high-starting torque, predetermined speed setting by means of the speed-setting knob on the front of the case, vibrating field relay, assuring starting with full field, and dynamic braking when stopping, etc.

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Oil-Immersed or Air-Break Explosion-Proof Button

AN EXPLOSION-PROOF PUSH BUTTON, type EO, the construction of which makes it suitable for use in oil industries, grain elevators, dry cleaning establishments, plants manufacturing explosives and other industries where explosion-proof equipment is desirable or imperative, has been announced by the Electric Controller & Manufacturing Company, Cleveland, Ohio. The contact mechanism of this push button is ruggedly built and is exceedingly simple in design. The base is of insulated material, on which are mounted the contacts and terminals. The contacts are made of heavy copper bar and are designed to provide a wiping action when a circuit is made or broken. A single large compression spring insures ample pressure between contacts.

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Standardized Control for Mobile Lighting

A STANDARD "THYRATRON" REACTOR control equipment, type CR7502A1, for use in governing the operation of mobile color lighting, has been announced by the General Electric Company. This unit is designed for a wide range of applications, including exterior flood-lighting, show window lighting, outdoor or indoor advertising signs, electric fountains, etc. Heretofore equipments for use in these various applications have been designed more or less specially for each individual case, whereas this new design allows the control for the majority of installations to be built up of standard equipment.

Mobile color lighting control is made possible by the thyratron tube, a three-element rectifying tube, the output of which is always under control. The amount of flow of the rectified (direct) current is regulated by the application of the proper voltage on the grid circuit of the tube. Therefore, the thyratron tube may be considered as a combination rectifier and regulator which is independent of metal contacts, brushes, etc., and produces smooth, gradual changes in the flow of current, a feature that cannot be obtained with the resistance dimmer.

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AN ELECTRIC TOOL GRINDER using the modern welded steel construction has been announced by Forbes & Myers, Worcester, Mass. The grinder has 10x1-in. wheels, mounted on the motor shaft, and operates at 1,800 r.p.m. Tool rests are provided for the left end only. It is adjustable in two directions. The right wheel has a larger opening for work that cannot be handled on the regular tool rest. Both wheels have permanent guards. Ball bearings are of the grease seal type, packed in sufficient grease for a year of ordinary use. The motor is inclosed from the outside air, but is cooled by a circulation of air through the stand. It is of the induction type, $\frac{3}{4}$ hp., 110, 220, 440 or 550 volts, one, two or three phase, 25 or 60 cycles. Motors for other current can be supplied as specials.

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Safety Switch Has Patent Receding Blade

A NEWLY DESIGNED SWITCH with patented receding blade construction is announced by the Trumbull Electric Manufacturing Company, Plainville, Conn. It is designated type R. B. safety switch and is specially built for heavy duty.

According to the manufacturers, this switch will operate thousands of times without deterioration of contact surface due to the double-break contact feature which breaks the current on the outside of the current-carrying surfaces.

The path of the current does not pass through any hinged, soldered or riveted connections, which, it is claimed, makes a stronger and more compact switch unit and reduces voltage drop.

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